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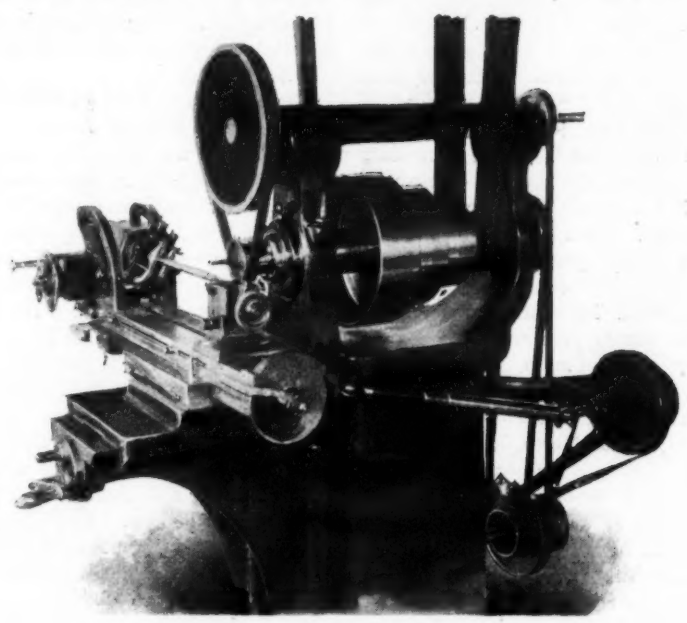
High-Speed Milling Device—Expansion Collars.

BY WARREN E. WILLIS.

The kindness of the inventor, Mr. F. A. Pickens, enables me to illustrate an excellent device for high-speed milling. It has the advantages of comparatively long belts; can be used in machines whose arm supports have or have not a web between; has a range of speeds equal to the changes of cones on both spindle and feed mechanism; can be readily applied or detached, and does not interfere with any function of the machine.

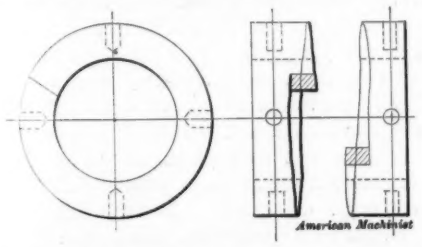
As can be seen, it is quite simple, consisting of a shaft with two flange pulleys carried by disks fitted to the arm support holes. These disks are bored out of center for the bearings, thus allowing the belts to be put on with ease and afterwards tightened as desired by partially revolving the disks; the cutter revolving in the same direction as the main spindle, reduces the wear and allows the shipper to be used as ordinarily.

While not advocating the use of the universal milling machine as a surface grinder, this arrangement admits it to be so used if thought desirable, and I admit having done such a job upon it in grinding some fine broaches, whose teeth were required to be exact, with satisfaction as compared with a previous attempt on a high-grade grinder.



HIGH-SPEED MILLING ATTACHMENT.

A convenience where using straddle mills or gang cutters is a few pairs of what may



be called expansion collars for want of a better name.

These collars differ from the ordinary in having the adjoining faces in a helical shape, so that by moving one upon the other the distance between their extreme ends will be varied.

These may be easily made in the lathe geared up as for cutting a screw, but using a side or parting tool and cutting all the way through. Such a pitch should be chosen as will not give too great an angle, say six to the inch, which will be well within the angle of repose, and the faces will not slip upon each other when pressure is brought to bear against them.

Making a Miter-Gear Pattern.

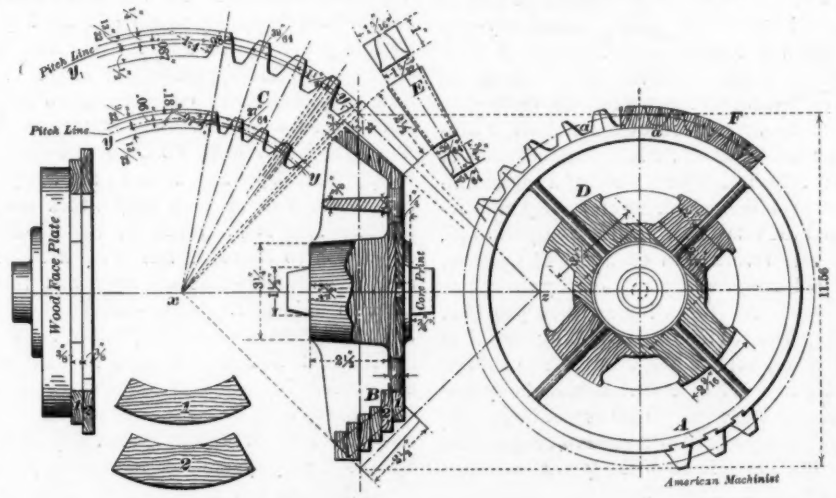
BY P. S. DINGEY.

A miter gear is always a bevel gear, but a bevel gear is not always a miter. To cast a pair of the former, which will mesh and run together, only one pattern is required, while in order to cast a pair of other bevel gears two patterns are necessary, because the angle in each is not the same on the face, and they each contain a different number of teeth, whereas in each gear of a pair of miters, the angle is the same, and also the number of teeth.

When looking for a certain gear pattern among others, an experienced patternmaker can generally distinguish the difference between a miter and any other bevel without trying the angle, but where only a small difference occurs between each in a pair of bevel gears, it is not easy to distinguish a miter from any other bevel gear, without testing or referring to the records. For this reason it would seem proper to stamp "miter" or "45°" on miter gear patterns. This suggestion is made, believing from experience that if this practice were adopted it would, to say the least, be a matter of convenience.

Nothing new is claimed for the manner of making the gear pattern shown, although the method is not a general one, making and fastening the teeth on the rim being where it differs from the general way of doing. Dovetailing blocks on the rim like shown at *A* is a common way of doing, and is done to enable them to be driven out again, the dovetail being made taper. Another way is to glue the blocks for the teeth on the rim without dovetailing them, and then to shape the teeth in place—the rim of the wheel in both instances is turned to the diameter intended. In the method presented, it will be seen that the rim is turned under the size, the deficiency being provided for on the blocks for the teeth.

The first of these three plans is by no means a bad one, as it allows the blocks to be removed for dressing the teeth separately—it does not, however, permit of a fillet being worked at the bottom of the tooth. The second is not good, because if a fillet be made at the root of tooth, as the custom is in this case, the feather edge thus formed is liable to curl up. Another bad feature is that all the teeth must be dressed off in place, which is not so easy to do as when blocks are removed. As to the method advocated in this article, we have the advantages of a fillet, which is desirable, at the root of the tooth without the feather edge, and of removing every other block for shaping the teeth. Also it will be seen that all the joints of the segments forming the rim are covered between the teeth, which the molder knows is a good thing.



Mitre Gear Wheel Pattern
11.56 dia: 1¼ pitch 29 teeth

MAKING A MITER GEAR PATTERN.

To make the pattern represented a full size section of the rim must be first drawn out as at *B*, in order to know the width, thickness and diameter of each course of (six) segments. The profiles of the outer and inner ends of the teeth, which are shown at *C*, are drawn the same as the teeth for two spur gears, whose radii are $x\,y$ and $x\,y_1$, with pitches corresponding to the inner and the outer ends of the teeth, and the number of teeth contained in each circle. It is seldom that these two circles y and y_1 can be spaced without a remainder; this fact, however, affects nothing, as it does not materially alter the shape of the teeth in a gear wheel of this size, by selecting one or two teeth, more or less, for drawing the profile.

The rim is built on the face plate commencing with the course marked 1. A piece of paper is glued under each joint between the first course and the face plate, which is sufficiently strong to hold the work for turning, if carefully done, and may be pried off with a chisel when turned, thus obviating any screw holes being made in the pattern. When the rim is turned on the inside, and before removing it from the face plate, the four arms should be let into and glued to the rim as shown at *D*, the arms having previously been half-checked together in two pieces and formed. The hub is turned on a screw chuck a little larger than sizes given, and glued to the arms. When the glue has thoroughly dried the arms should be faced off and the hub finished, making it run exactly concentric with the rim that the pattern may be chucked by the hub and thus again save putting screws in the rim.

A larger wooden face plate than the one shown will be needed for chucking, having a piece about 6 inches diameter and 1 inch thick glued on to take the hub; this face plate will serve to support the rim and prevent the pattern from trembling while turning the outside and teeth, the original one not being large enough for this purpose.

The reason why the first wood face plate was not made large enough to serve the purpose, was that room might be given to rough-turn the outside of the pattern, for experience in lathe work has proved that before chucking it is well to do as much work in the first operation as it is possible to do.

In getting out the blocks for the teeth they should be made about $\frac{1}{16}$ inch longer than given at *E* for turning off the ends. No nails or screws need be used in the teeth until the pattern is finished, indeed, there were none used in this pattern, which was made not long since in the manner here described.

The rim being turned it is spaced off on the face for the teeth, the lines being drawn toward z by the use of a Starrett's center square. The blocks for the teeth are fitted on the rim as at *F*, all being glued together, *but only every alternate one is glued to the rim;* they are thus secured for turning, and when turned every other block may be taken off for paring after sawing between each, making it also easier to pare those glued to rim. Particular care must be taken when gluing not to allow any glue to get on the sides of the blocks near the rim, as at a, for instance—only fresh made thin glue should be used.

Increased wages mean increased consumption, and increased consumption means increased wages; why should they not continually help each other along instead of only operating for one swing of the pendulum?

High Speed Without Knock.

By Chas. T. Porter.

Nearly twenty-five years ago I made the following exhibition in the presence of Dr. Barnard, president of Columbia College, Thomas J. Sloan and Robert Weir, the Judges of Award in the Engineering Department at the Fair of the American Institute, in New York City, in the year 1870. The exhibition was given with my little shop engine, cylinder 6 inches by 12 inches, regular speed 800 revolutions per minute, at Harlem, where I was then commencing the manufacture of high-speed engines. I kept Saturday afternoon holiday, one of the good things I had brought from England, and so one Saturday afternoon I had a clear field for this exhibition.

I had previously prepared two governor pulleys to speed the engine up to the increased speeds required, which speeds had been ascertained by calculation. I was so certain of the correctness of this calculation that I did not make any preliminary trial, did not think of such a thing.

After running the engine for a short time at its usual speed, I changed the governor pulley for the smaller one of the two I had prepared, by which the speed was increased to about 400 revolutions per minute, and loosened the crank-pin brasses so that they were slack fully a thirty-second of an inch. On starting the engine in this condition, of course it pounded violently on the crank pin. As the speed was gradually permitted to increase the knock softened, and just before the governor rose it disappeared entirely, and at the calculated speed the engine ran in entire silence.

After running for a while in this manner I prepared for the second part of my show. I put the crank-pin brasses back to their usual running adjustment, loosened the brasses of the crosshead pin a full thirty-second of an inch, and put on the larger governor pulley which, if I remember rightly, ran the engine at about 550 revolutions per minute.

On starting the engine pounded, of course, heavily on the crosshead pin. As the speed increased the same effect was observed as on the first trial, only later in the course of the acceleration, and again just before the governor rose the pounding had completely died away, and at the calculated speed the engine ran in absolute silence.

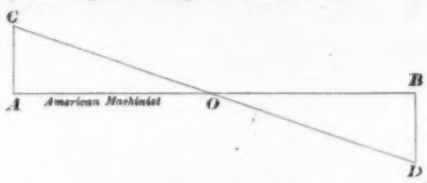
Like everything else, this action seems mysterious until it comes to be understood, when it is seen to be quite simple. As it will play an important part in the more complete development of the high-speed system, which is soon to be inaugurated, I would like to ventilate it briefly through your columns for the information of any to whom it may be new, although engineers are now generally familiar with it.

The crank of a steam engine passes its dead centers under the full centrifugal stress of the reciprocating parts; that is of the piston, or, in the case of a tandem compound engine, of the pistons, the piston rod, the crosshead and the connecting rod. At these dead points this stress is the same as if the weight of all these parts was gathered at the center of the crank pin, and for a little distance on either side of these points the stress is practically constant.

The reason for this is as follows: At the middle of each stroke the reciprocating parts have attained their full velocity. At this point the retarding pull of the crank upon them commences insensibly, then increases more and more rapidly, until at the end of the stroke it has reached its maximum, and has brought these parts to rest, and then continuing puts them in motion in the reverse direction, its force gradually diminishing until at the middle of the return stroke these parts have got their full velocity in this new direction, and the force exerted by the crank on them in this direction insensibly ceases.

This force, first retarding the motion of the reciprocating parts in one direction, and then imparting motion to them in the reverse direction, is, at its culminating point, the dead center, where the reversal in the direction of the motion takes place, equal, as already stated, to the centrifugal force which these parts would have if they were revolving with the crank.

This acceleration and retardation, at every point in the stroke, is properly represented by two equal triangles, as follows:



A B is the length of the stroke. *A C* and *B D* represent the centrifugal stress under which the crank passes its centers. The pull of the reciprocating parts, resisting the force which is exerted to change their rate of motion, begins and terminates in each direction alternately, insensibly at *O*.

The stress on the centers in pounds is readily computed by the formula, $W\ r\ R^2\ c$, in which W is the weight of the parts, r the radius of the circle, or length of the crank in feet, R the number of revolutions per minute, and c the decimal .000341, which is the centrifugal force of one pound, making one revolution per minute in a circle of one foot radius. It is thus seen that this stress varies as the weight of the parts, as the length of the crank, and as the square of the speed.

In slow-moving engines it amounts to but little, but in high speed engines it becomes important and useful. In the case above described it amounted to more than the steam pressure. Then when this pressure was admitted to the cylinder it was not sufficient to relieve the crank entirely, but the latter passed its centers under some stress. The steam pressure came on the crank afterwards, and in so gradual a manner that the brasses overtook the pin without causing any sound. This will be understood when it is considered that they overtake the pin as soon as the pressure becomes sufficient to move them, and so, of course, they must come in contact with it in the most gentle manner.

In an engine running under these conditions it is immaterial how suddenly or at what precise point the steam is admitted, or whether or not the admission is preceded by compression, or whether the crank-pin brasses are closely or loosely adjusted, the engine *cannot* have a knock on the centers unless the compression should be so excessive as to raise the pressure in the cylinder above the boiler pressure before the port is opened for admission.

Gasolene Road Carriages.

By W. H. Booth.

There is just now a movement on foot in France in connection with mechanically propelled road vehicles that is likely to have some permanent results. The outcome of the movement has been a race for vehicles to run on the common roads, from Paris to Bordeaux and back to Paris, a total distance of about 900 miles. Though out of a total number of vehicles which started only nine returned to Paris within the 100 hours allowed, the best returned in 48 hours 48 minutes, and had run steadily and evenly the whole distance. All the winners were provided with gasolene motors, excepting the last which was a steam propelled vehicle. Some were propelled by electrical machinery and secondary batteries. So far as can be judged from the reports of the trials in conjunction with one's own ideas of the general mechanical fitness of things, the gasolene motor appears not merely to be the winner, but it is difficult to see how any other mode of propulsion could be the winner, excluding, of course, a vehicle electrically propelled by means of a picked-up current. But current cannot be picked up, except from a suitable conductor, and electrical propulsion is thus practically confined to such roads as it is commercially possible to supply with such conductors. The steam engine, again, is an exceedingly heavy vehicle with its boiler and load of coals for running along a road, even if such road be as good as are the roads of France. Then the steam engine requires stoking; it is liable to cause coal-dust and grime.

The gasolene engine has none of these faults. It requires no boiler and has a comparatively small weight. It occupies little space. Its fuel can be stowed away in a tight box or tank, and a small weight of fuel represents a goodly number of miles traveled. Altogether, for purposes of the open country, the gasolene motor appears to have come to stay, and it affords one more illustration of how modern inventions and improvements enable old contrivances to be utilized. The railroad to a very large extent appeared to render our splendid system of roads unnecessary and almost useless, and the old wayside coaching inns decayed. But the bicycle came along and altered all this and quite re-established both roads and inns, and now, in France at least, the gasolene motor bids fair to still further extend the use of the roads. In America where you have, comparatively speaking, no roads as we understand them here, their absence has been a great factor in urging forward first the horse railroad, then the electrically worked road, whereas here tramways have made comparatively little progress because they have been in competition with roads of good and smooth surface.

There is a law here connected with the use of steam engines on the roads which says that they must not be driven faster than four miles per hour in the country and two miles in city limits, and must be preceded by a man bearing a red flag. This law was, of course, passed through Parliament by the people who owned the railroads, and by those who could afford to drive their own horses, and it has resulted in the confining of steam-road vehicles to the traction engine and steam-roller type, and discouraged any attempt to build lighter vehicles. The immediate effect of the French trials has been to stir people up against the law, which would practically prohibit their use in England, and the law will have to go, and there will be a good sale for gasolene vehicles before very long. In my own case, were I possessed of such a vehicle, I could use it over hundreds of miles of the best of roads within 100 miles of London, especially in such parts of the country as are served by the worst of our railways, and on which it is difficult to average a speed of more than eight miles per hour. With a self-propelled carriage and the saving of the time now occupied in waiting for trains and in walking or driving from the train to the place one desires to reach, a gasolene carriage would amply repay its cost. I should advise American builders of light carriages to keep an open eye for the development of the gasolene motor and of the English law on the question. With the abrogation of the law there is sure to be a demand for such light carriages, especially among those who are a little too old to propel the bicycle, as well as from the host of drummers who now waste so much time on the slower railroads, and engineers like myself who have work to attend to at widely distant points. It is a peculiarity of the railroads here that they avoid many towns. This is the result of the old-time opposition to railroads, but every little village is on a first-class highway, and there are two distinct Englands—the England of the old highway and the England of the railroad, and I believe the same may be said of France. My own opinion of future transit in the country is that there will be slow freight traffic conducted electrically either by the trolley system on the highways, or by tramways, and a more rapid passenger traffic with gasolene carriages. But for city work the gasolene carriages will not be very much employed because of the very inflammable nature of the fuel. One thing is certain, our steam railroads have failed to meet the needs of the country, excepting only within very restricted lines. We can get from end to end of the land very fast indeed, but it takes as long to go and see one's friends between north and south London as to reach Bristol on the opposite coast. There is room somewhere for a big trade in locomotion facilities.

The Senator Invents a Trolley Fender.

By Frank Cawley.

My friend, the Senator, has invented a fender. I will not mention his constituency nor even his nationality, for any one can invent so simple a thing as a fender.

The Senator's fender, however, had some peculiar features about it which made it different from other fenders; for instance, it was a very humane fender, any child could use it and imagine that he was swinging in a hammock or peacefully sleeping on the maternal breast. Likewise dogs, and thin men, and fat women who have just got off the other car backwards, all could seek calm repose on this most humane fender.

Then, again, it was a very cheap fender, and the trolley companies could easily afford to put one on the business end of every motor car, even when both ends were business ends. Moreover, these companies when very young, or immediately after the last strike, are sometimes in financial straits. In such cases one fender can easily be made to do for both business ends. For is it not light, and has it not two side pieces and two wheels which together make a most beautiful whirligig which it should be a pleasure for the sportive motorman to push like a perambulator to the other end of the car while the conductor counts his transfers and shifts the trolley pole—a pleasure even through banks of snow and depths of chilling mud?

In construction, as I have already mentioned, it consisted of two side rods hooked into eye bolts, one at each side of the front board of the car; an axle and two flanged wheels, and geared from this axle was the most important part of the whole, a rubber roller revolving backwards which would pick up anybody or anything that came within its reach and gently lay him, her, or it on the netting which surmounted the whole and was a part thereof. No extra royalty was to be charged for the gravel stones and dust which this roller would throw into the eyes of the patient motorman—or of the unsuspecting directors.

Under the netting were two diagonal stay rods, braces I think he called them, which were to keep the thing square and up to its work. Each of these rods had adjusting nuts, which were to allow them to be loosened enough to allow the fender to swing at curves. All this I learned from the Senator himself and from a blue print of a very finely executed perspective which had been prepared by the Patent Attorney, and which showed the fender all ready for business attached to the front of a car.

Trouble was anticipated at curves and switches and at suburban points where the small boy is omnipotent, and the fender was provided with a *lever* with which the motorman could easily lift it over bricks, toy houses, etc., which might not be wanted on the netting. This lever was, of course, not shown (they never are), but it was very simple, and in arranging for the construction I could easily put it in. It is, by the way, a very useful thing to know—young inventors, please take notice—that a *lever*, especially a *bell crank* lever, together with the pressure of the little finger can accomplish any mechanical feat, and usually in such simple manner that it is quite unnecessary to show it.

My first real introduction to this fender took place at a pre-arranged meeting between the Senator, the foreman of a machine shop, and myself. The foreman was to give an off-hand estimate of the cost of building, and I was to arrange details and superintend construction. Work could be begun immediately, and the fender was to be ready for trial *next Saturday*.

It is hardly necessary to inform the mechanical reader that none of these things came to pass. The foreman could make no estimate from the data given us; I could give no details until I had made some sketches to scale; and construction could not possibly begin until this had been done.

That evening a very short interview with my drawing instruments told me that my doubts were well founded, and it made no

difference *which angle* was used for the projections. American Machinist readers will understand this reference. Accordingly, when the Senator called next day, I was obliged to tell him that the stay rods would require about two feet of slack in them to admit of the fender swinging on curves, and that when on a curve the rod not in use would be two feet slacker, and would drag on the ground, and I advised him to leave them off altogether. I told him that owing to the similarity between his fender and a parallel ruler, that the axle of the fender would remain parallel to those of the car, and that on sharp curves instead of being radial with the curve, it would be inclined to the radius at about the same angle as is the shaft of the rotary sweepers—which are so useful in depositing the snow from the road-bed upon the sidewalk—and this angle would oblige the fender to make tracks rather than follow them. A lever to lift the fender, I explained, was altogether out of the question, for when the motorman had one hand on the brake and the other on the controlling crank, one foot trying to kick the gong loud enough to move a bread cart, and the other being required to stand on, not even a finger remained to operate a bell crank. And men with more hands or feet than the ordinary *genus homo*, can make more money as freaks than they can command for kicking bells and pulling levers for the trolley company.

The lightness of the fender disappeared when details began, and instead of the motorman of a financially embarrassed road moving the fender gayly from one end of the car to the other, conductor and motorman together would be glad to drop it.

As a final reason why he should not take contracts for the supply of these fenders in a hurry, I told him to look up the catalog marked Fenders in the U. S. Patent Office and that he would find that he had a dozen patents (each equally dear to its inventor as was his invention to him) to purchase before he could save the life of one small boy who, as boys delight to do, was innocently playing tag with the trolley cars.

This interview, I am afraid, killed one, at least, of those remarkable inventions, which occasionally find their way into the daily papers. I have seen little of my friend since then and nothing of his fender.

In all the essential parts the above narrative is true, and I have written it to add a little to the sound advice already given in these columns to would-be inventors: Don't be in too big a hurry. If *you* don't know, perhaps some friend who *does* know about pumps, locomotives, or whatever else your invention is to improve, may tell you, and above all find out what has already been invented.

Montreal, P. Q.

A Practical Test of Armor.

The failure of the heavy projectiles to penetrate the Chinese armor which they struck, while it strengthens the argument of those who favor the battleship as the chief constituent of naval force, deserves the close attention of all persons, lay as well as naval, who are perplexed by the alternate crowing of both parties in the wearisome contest between guns and armor. The result shows that armor is actually a far better protection than is indicated by the trials of the testing ground, where for purpose of extreme proof, all of the off chances are given to the gun. On the trial ground the victory of the gun has, with occasional fluctuations of opinion, been generally taken as proved; in the Yalu fight the armor, thanks to the operation of causes carefully excluded in testing, came out ahead when it was struck.—"Lessons of the Yalu Fight," by Capt. A. T. Mahan, in *The Century* for August.

Shop Notes—A Kink in Heating—Wash-Room Furniture—Attaching Countershafts.

At the new shops of the Leland & Faulconer Mfg. Co., Detroit, they have an arrangement of the heating system that is apparently unique. They use the modern system of steam-heated pipes in a closed compartment, into which air is driven by a fan and then distributed about the building where it is wanted, but instead of being obliged to take their air from outdoors all the time, they can take it from a 2-foot space under the floor, if desired; registers allowing the cold air near the floor to pass down into this space, from whence it is drawn by the fan, heated, and returned to the rooms. It is found that this works well, especially for the first few hours in the morning, when the weather is very cold, pains being taken to open the conduit admitting outside air before the inner air has become appreciably vitiated.

Another heating device was noticed which consisted of a small exhaust fan set in an opening in a brick partition wall between the boiler room and a small smith shop, which latter it became desirable to heat somewhat. The lack of heat on one side of this wall was considered in connection with the surplus heat on the other, especially in the space above the boilers, and the fan was arranged to simply take this heated air through the wall, from where it was not needed to where it would do the most good. Of course the steam engineers will point out that all the heat taken out of the boiler room in this way has to be supplied by combustion of coal in the furnace, but in this case, at any rate, the difference in coal consumption is not noticeable, while the effect of the increased comfort of the men who are most directly concerned is quite apparent.

One of the features of this new shop is a modern wash room, the principal piece of furniture in which is shown by Fig. 1, which gives a plan, side, and end views, in which *A* is the sink; *B* is a 4-inch steam pipe; *C* is a V-shaped wood trough for soap; *D* is a cast-iron post bracket carrying the pipe and trough; *E* is one of the delivery pipes and cock, the pipe passing up to near the top of the 4-inch pipe, and thus taking the warmest water out of the pipe; *F* is the supply pipe from the hydrant; *G* is a ½ inch steam pipe loop passing inside the 4-inch pipe about two-thirds its length and returning; *H* is the other end of the same pipe, with a pet cock through which the condensation is drawn out; *I* is a valve, the stem of which has been prepared for a triangular shaped key; this prevents the valve being adjusted by anyone except the man who has been assigned to the care of the sinks; *J* is a valve of similar construction to *I*, just described; *K* is a safety valve; it was found necessary to have this valve on account of the pressure from the expansion of the water when the jet of steam is turned on.

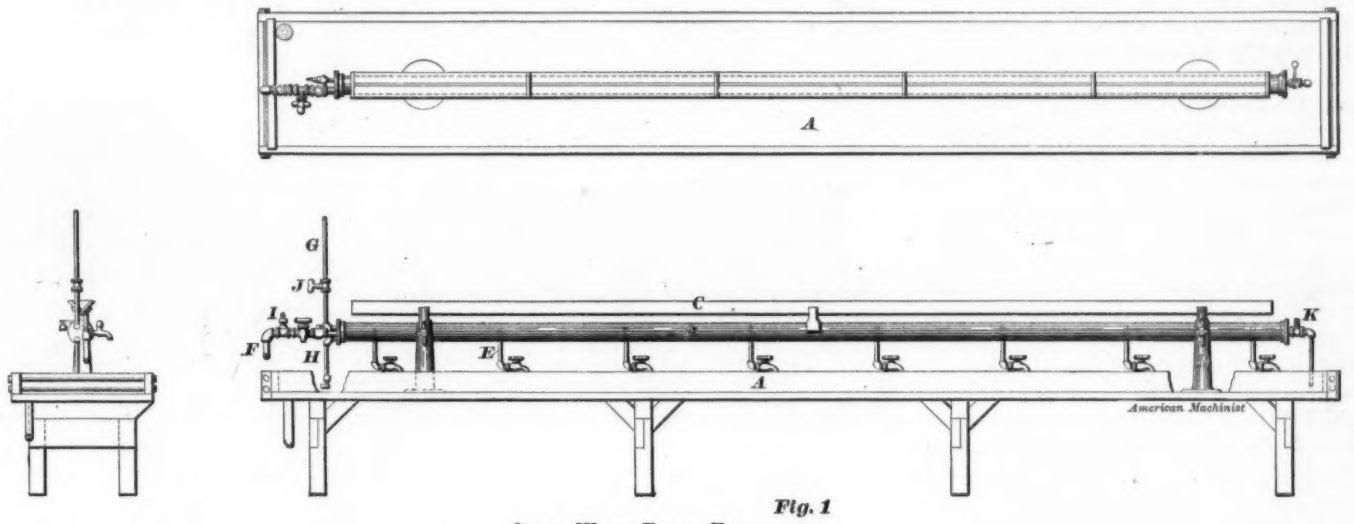
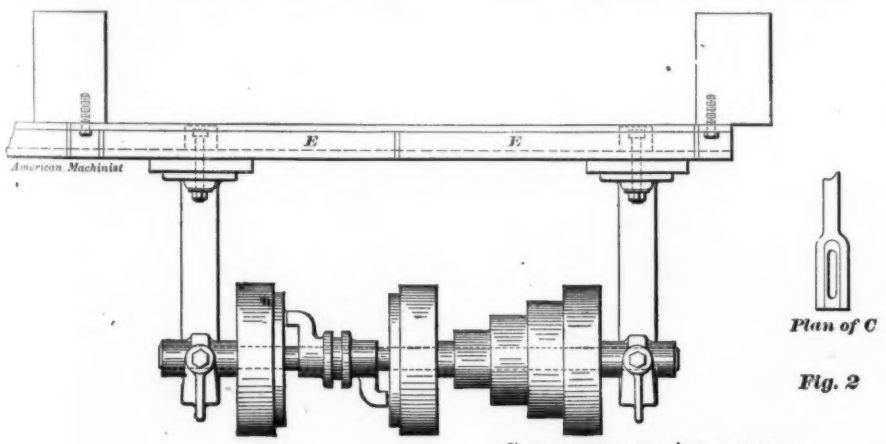


Fig. 1

Shop Wash-Room Furniture.

There is a basin in the sink for each man. These are always ready with water at quitting time. Having washed his hands, the man dumps the water and draws fresh for his face from one of the cocks *E* without moving from his position.



Plan of C

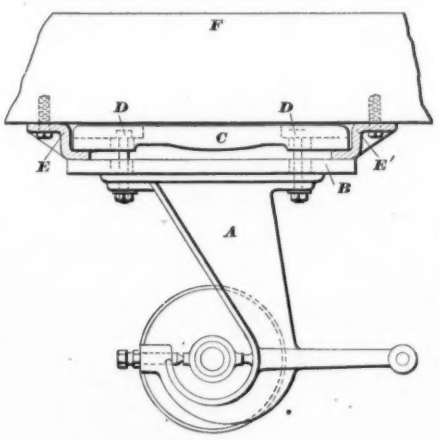
Fig. 2

Countershaft Attachment.

For attaching countershafts to the overhead timbers they use a very neat and convenient device, shown in Fig. 2 at *E E'*. When this plan was first thought of, it was intended to procure rolled shapes of the section indicated, but as these could not be had quickly enough, a pattern was made for castings, which have answered every purpose.

Referring to the end view, *F* is the floor joist; *E* shapes which are placed as far apart as is required by the widest hanger in the plant, and in a continuous line with the main shaft over each row of lathes or other machines; *A* is the hanger; *B* is a 1-inch maple piece, which, as the hanger is clamped to it, compensates for the irregularities of the foot of hanger; *C* is the strap having an elongated slot and walls on each side to prevent head of bolt from turning, the strap being clamped by bolts *D*, as shown.

This is a very neat and satisfactory arrangement. The countershaft can be moved much or little, as may be desired, in a few moments without boring holes or hammering the hangers. It can also be moved from one line of supports to another readily, and the whole arrangement as seen in this shop is of those things that will take the eye of the mechanic who likes to see things looking as though thought out in advance, and with their objects kept clearly in view.



A Municipal Hydraulic Power Supply.

There have recently been completed and formally inaugurated in Glasgow, Scotland, a hydraulic power supply works. The works belong to the water department of the city, and are to supply water under a pressure of 1,120 pounds per square inch, for operating hydraulic lifts, presses, etc. A similar service has been established in London more than ten years, now having 75 miles of mains, supplying 2,300 machines and bringing in annually a revenue of $250,000. The pressure employed in London is 750 pounds. In Glasgow, the present needs of the city being represented by about 100 hydraulic presses and 600 hoists, provision has been made for a prospectively largely increased service. The present plant comprises four large Lancashire boilers, with economizers, three sets of pumping engines of 200 horsepower each and two accumulators. Each engine will pump 230 gallons per minute with a steam pressure of 120 pounds. The accumulators have rams 18 inches diameter and 23-foot stroke. In the application of this service to the operating of elevators in buildings, some peculiar old country views are brought out. The principal speaker at the opening ceremonies said, incidentally: "This new scheme would benefit proprietors in the center of the city by enabling them to get the use of *old* properties which it would not pay them to replace, and where there was a lack of facilities for getting to the top flats. There would be very little difficulty in two or three neighboring proprietors putting in a hydraulic lift and building an outside gangway leading to the separate properties." That looks like using an elevator in connection with a fire escape.

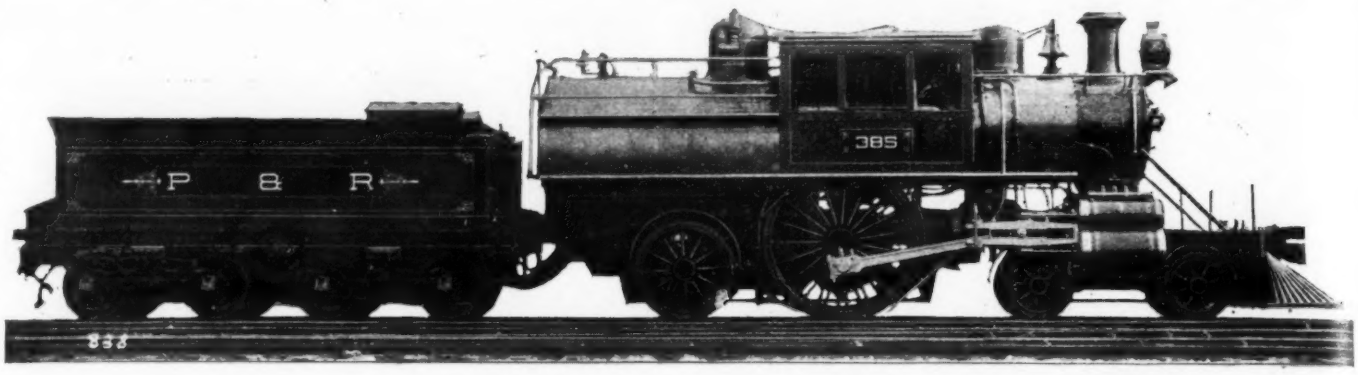
Novel French Boiler—Heated Feed Water.

By W. H. Booth.

A boiler has been recently described in the French press which consists of a water vessel entirely removed from the action of the fire, and of a bundle of small and fairly short tubes fully exposed to the most powerful action of the fire, and fed by a pump which draws its supply from the water vessel and delivers the water, already fully heated, through a small nozzle at the end of each tube, whereby the water is, to use the French description, pulverized and rapidly converted into superheated steam, which then escapes through a check valve below the surface of the water in the reservoir, and there causes a corresponding formation of steam. Economy is claimed for the device as well as the absolute precipitation of all scale-forming salts, or mud, in the reservoir,

whereby the tubes are preserved clean; and such is the efficiency of the heating surface that a given production of steam is secured by means of an area of heating surface but one-tenth of that found necessary in ordinary tubular boilers. The one noticeable feature serving to account for this superior efficiency, is simply the compulsory and rapid passage of the water over the heating surface, such water being already heated to steam temperature and only wanting the addition of the latent heat to become steam. Again, another boiler has also been introduced in France on a system termed the Systeme Dabiau. In this boiler there is arranged over the flue crowns or other heating surfaces, a sort of shell from which the only escape for the steam collecting in such shell is by the mouths of a number of tubes projecting downwards inside the shell and upwards into the water space in such a way that as the steam forces down the water inside the shell space, it begins at last to escape up these pipes. Now, the lower ends of these pipes are cut to a bevel and the steam carries up with it a lot of water. When the boiler is regularly at work this action is steady and continuous; all the tubes spout up water and steam, and the result is a very rapid circulation of water over the heating surface, and as the edges of these shells are carried down to the boiler bottom, they simply draw the water from that locality, where it usually lies cold and sluggish in inwardly fired boilers, and hot water fills the whole boiler. Again, we have time to time that there is at least good reason to expect that there is some unsuspected cause acting to produce such results as are noted. Taken in conjunction with the above two French systems of boilers and with one's general experience, does it not appear exceedingly probable that the transfer of heat is more rapid and effectual between surfaces of even temperatures than between surfaces widely different in temperature? The phenomena of cylinder condensation and re-evaporation appear to be conducted with an extraordinary rapidity, and they occur between substances not enormously differing in temperature, and I think that the general evidence is in favor of the idea of rapid heat transference under circumstances such as those which obtain in steam boilers. When light passes from one substance to another of different density, it is of the refraction due to temperature differences, which is removed or reduced as the water becomes hotter. If such then be the case, and that something which gives a like result does obtain appears probable, then we should learn from this that when once we have got hot water, we must only heat further water by means of steam raised from such hot water. All heating of water in the boiler must be done by steam, and steam must only be produced by adding heat to water already raised to the boiling point by means of steam injection. M. Normand, the French torpedo boat builder, has given much attention to this question, and the French, so generally scientific as engineers if they lack something of our own direct methods, appear to have been thinking further on the subject, with the results I have named. It has been held to be rather mysterious that already upon the point of boiling, then its capacity for absorbing heat from the plate it touches is enormously increased, for steam is formed and absorbs at once its latent heat and does not even increase its temperature in doing so. This seems to me to be the most reasonable explanation of the superior efficiency of boilers using what we may term self-heated feed water, the moral being that all feed should be hot, even if live steam be used to effect the heating, and that circulation should be attended to more than it is, and not left to chance. I have seen no satisfactory explanation of the fact which has been treated as a mystery—a favorite way of treating subjects which are a little outside our ordinary range of thought and observation, but until I see a better explanation I shall stick to my own theory, that it is the capacity of steam for heat of evaporation that explains the whole phenomenon.

London.



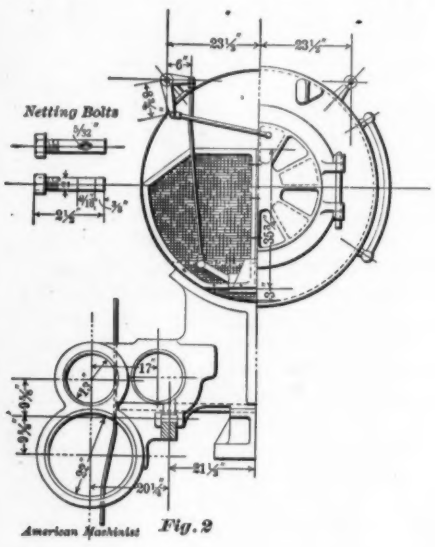


Fig. 2

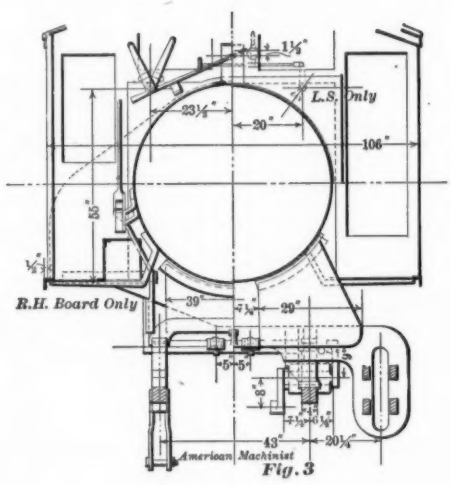


Fig. 3

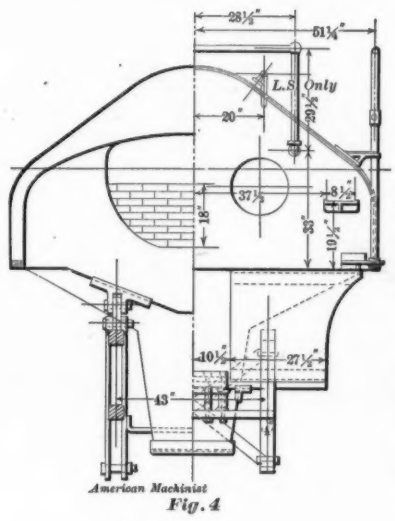


Fig. 4

Single-Driver Locomotive.

The accompanying illustrations are of a single-driver locomotive recently built at the Baldwin Locomotive Works, Philadelphia, for the passenger service of the Philadelphia & Reading Railroad.

Locomotives with a single pair of drivers have previously been used in this country, but have never become as popular as in England, where they are used to a great extent. This new engine, however, has, so far, done excellent service, and it may be safe to say that she is one of a class destined to become a distinctive and popular type of American locomotives, in which are combined many features peculiar to ordinary American practice. She was fired up on July 3d for a short run, and was reported to be very satisfactory. On July 4th she hauled a special train to Bound Brook and return, a distance of 120 miles; on the next day she was placed in regular high-speed

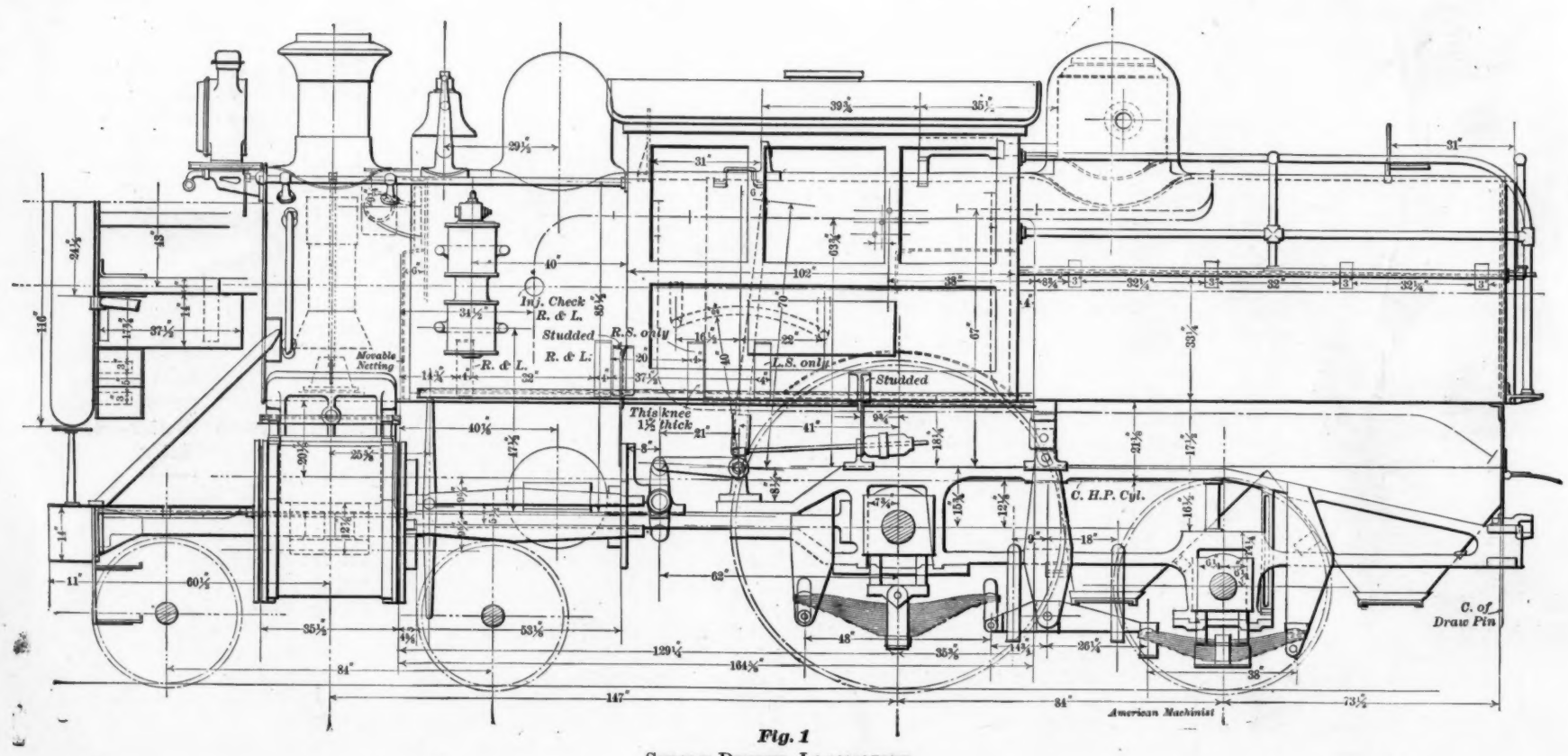


Fig. 1

Single-Driver Locomotive.

heard from time to time that the plan of heating feed water by means of live steam drawn from the boiler is productive of greatly increased efficiency, though apparently we have but transferred heat from the steam space to the water space. There are so many facts of this nature presented from bent out of its straight path—refracted the word is—as one may see in the case of a stick put partly in water and partly in air; the stick appears bent. Is it possible that a somewhat analogous action takes place when heat tries to pass from hot plate to cold water? It cannot do so directly because you could secure an economy by using live steam as a feed-water heater, but I see no occasion for this view at all. Where water passes over a hot plate, each pound of water can only abstract one heat unit from the plate for each degree of temperature absorbed by the water. But if the water is

service, and has run regularly ever since, hauling trains consisting of from four to seven vestibuled cars between Philadelphia and Jersey City. It is reported that she is an exceedingly easy-riding engine, runs smoothly over curves, and keeps a steady steam pressure of 200 pounds in her boiler.

The side elevation, Fig. 1, shows the general arrangement of parts. It shows a four-wheeled leading truck, and a pair of trailing wheels connected to the driving wheels by a system of equalizing levers. The dome is placed at the rear of the cab; this gives a clear and roomy cab, and enables the engineer to see signals readily. Owing to the position of the cab, the reverse lever is attached directly to the lifting shaft. Fig. 2 shows the Vauclain system of compounding, and Fig. 4 indicates that the Wootten type of boiler is used.

The principal dimensions are as follows: Gage, 4 feet 8½ inches; diameter of high-pressure cylinders, 13 inches; diameter of low-pressure cylinders, 22 inches; 26 inches stroke. Total wheel base, 22 feet 9 inches; rigid wheel base, 7 feet. Total weight in working order, 115,000 pounds; weight on driving wheels about 48,000 pounds; weight on truck, 39,000 pounds; weight on trailing wheels, 28,000 pounds. The front truck is of the rigid center-bearing type, wrought-iron wheels with steel tires, 36 inches diameter, Vauclain type; axle journals, 5½ inches diameter, 10 inches long. Driving wheels, 84½ inches diameter; steel centers turned to 78 inches diameter, and secured to tires by retaining rings; tires, 3⅛ inches thick, 6 inches wide; driving axle journals, 8½ inches diameter, 12 inches long. Trailing wheels of cast steel, with steel tires 54½ inches diameter; journals, 7 inches diameter and 12 inches long.

Boiler shell of steel ⅝ inch thick and 56 inches diameter at smoke-box end, made with straight top and dome placed back over fire box. Fire box, Wootten type, 114 inches long and 96 inches wide, inside made of homogeneous cast steel; side and back sheets, ⅝ inch thick; crown sheet, ⅝ inch thick; flue sheet, ½ inch thick. Water space, 3½ inches wide at sides and back, and 3½ inches wide in front. Stay bolts of iron 1 inch diameter, screwed and riveted to sheet, and not over 4½ inches from center to center. Fire door opening formed by flanging and riveting together the inner and outer sheets. Tubes of iron, 13 W. G., 324 in number, 1½ inches diameter, 10 feet 3 inches long. Boiler tested with steam to at least 20 pounds above working pressure, and with hot water 40 pounds per square inch above the working pressure, which is 200 pounds per square inch. The grate consists of water tubes and bars. Feed water is supplied by 2 Sellers' 1887, No. 10½ injectors placed on the right-hand side.

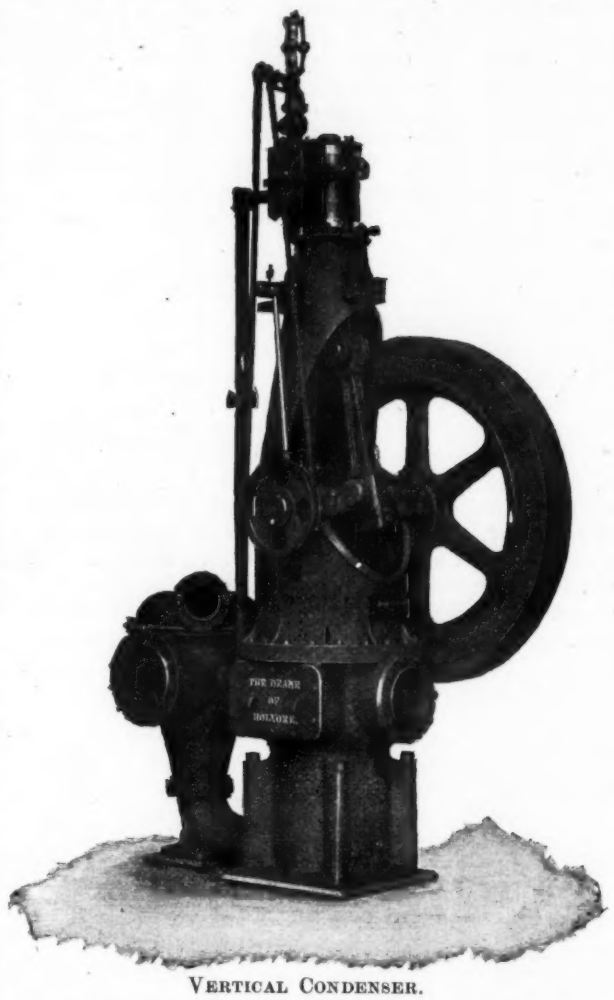
The tender is provided with a water scoop. The tender frame is made of 8-inch channel iron strongly braced. The two trucks are of the four-wheeled center-bearing type, with class "B." boxes; wheels, 36 inches diameter; the axle journals are 4½ inches diameter and 8 inches long.

The engine is equipped with the Westinghouse automatic brake applied to the drivers, trailing and tender wheels; a 9½-inch air pump is used.

It cannot be said that this new engine is an experiment, the results of this type of engine having been fairly well established by Mr. L. B. Paxson, Superintendent of Motive Power and Rolling Equipment of P. & R. Railroad, who had one of the eight-wheeled engines converted into a two-driver engine (commonly called a single-driver engine) by taking off the side rods. This engine worked so well that she was kept in service longer than was at first intended, and gave evidence that a single-driver engine would be well adapted for high speed service. The result is this new engine, designed by Mr. W. P. Henszey of the Baldwin works, under the general direction of Mr. Paxson. The engine is now pulling the fastest of the "Royal Blue" trains between Jersey City and Philadelphia, and has shown her ability to make very fast time. She is equipped with the Leach sanding apparatus, but does not show much tendency to slip.

A New Vertical Condenser.

We illustrate a new independent vertical air pump and condenser, one of several recently built by the Deane Steam Pump Co., of Holyoke, Mass. The machine shown has a steam cylinder 8 inches diameter by 12 inches stroke and the vacuum cylinder is 20 inches by 12 inches. The steam cylinder has a plain slide valve operated through a rocker by an eccentric on the crank shaft. The speed is controlled by a governor. The vacuum end is of the vertical, single-acting type and is connected to the condenser at the lower end. A jet condenser is employed similar in principle to that in use on the Deane independent condensing apparatus. The machine is new in design and construction, it is thoroughly self-contained, adapts itself readily to various situations and, as will be seen, is especially economical of floor space. Large hand holes are provided for the condenser to allow of interior examination. Suitable *companion* flanges are furnished for all pipe openings.



VERTICAL CONDENSER.

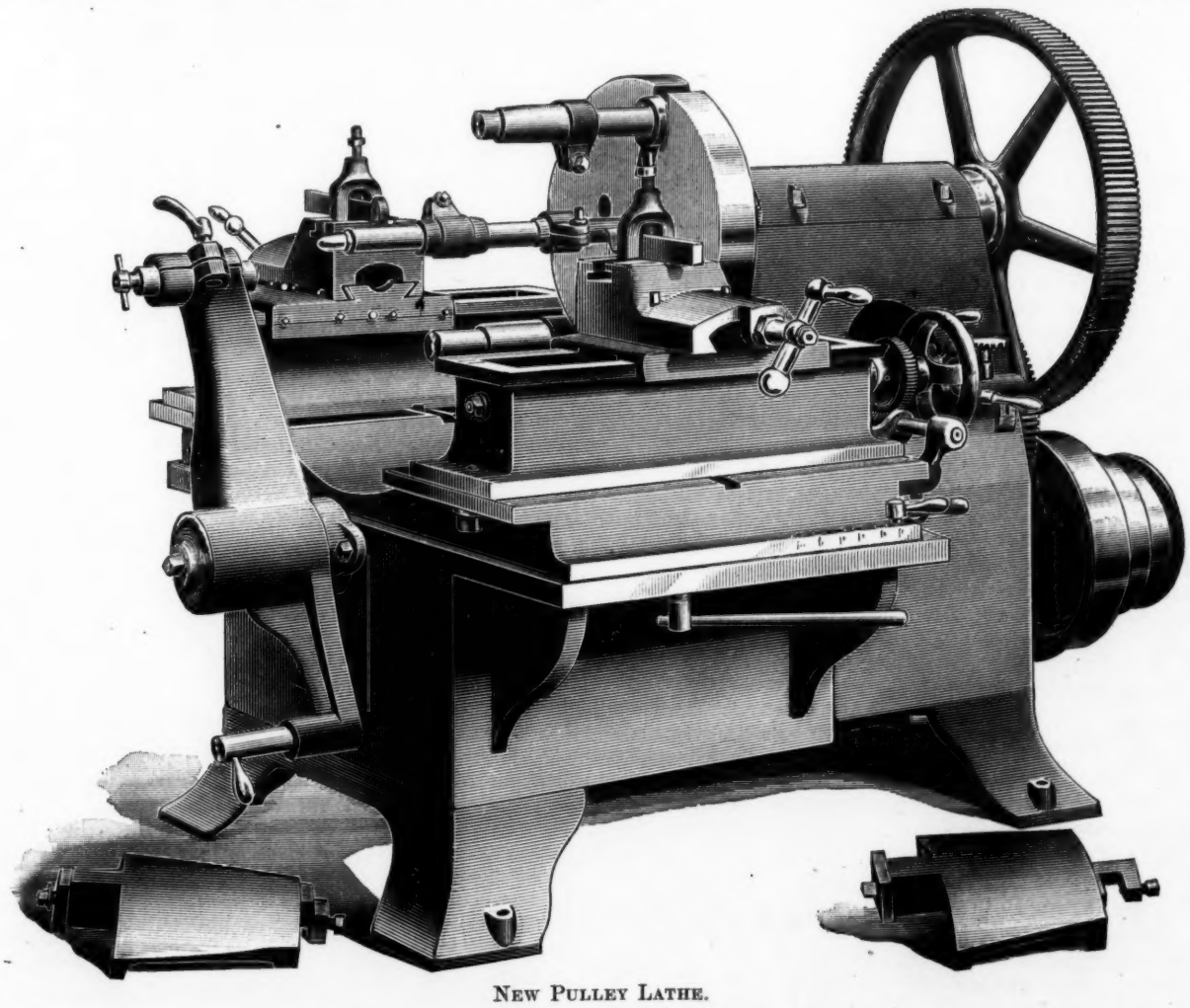
New Pulley Lathe.

We present on this page an illustration of a tool known as the Streit pulley lathe, which is being introduced by the Lodge & Davis Machine Tool Co., of Cincinnati, Ohio. It is designed to turn pulleys from 8 inches to 30 inches diameter, and they are held on an arbor which is fitted to the main spindle of the machine, and supported at its outer end by a tail stock that can be swung out of the way when the pulley is to be removed.

Instead of the usual separate adjustment for the rails for producing the crown, they are both mounted upon a bed plate which swings upon a pivot at the center, and thus insures the same setting for both rails. A series of holes into which a stop pin fits, locate the table for any given taper.

The machine is fitted with a three-step cone for a 4-inch belt, and is geared 35 to 1. Feeds have a range from the finest up to ⅛ inch.

It will be noticed that the head is massive, and it is fitted with a spindle $4\frac{7}{16}$ inches diameter, of cast iron. The front bearing is 8 inches long, the rear one 6 inches.



NEW PULLEY LATHE.

A correspondent wishes to know what chance of success a machinist would have in Chili or Uruguay. We do not know, but perhaps some of our readers in those countries will be kind enough to inform us.

LETTERS FROM PRACTICAL MEN.

Brakes and Fenders.

Editor American Machinist:

Your editorial on brakes for street cars ought to be followed up until the tone of the daily press is changed.

Someone started the cry about fenders, and the press has taken it up, and can think of nothing else. The question in all moving vehicles is not how fast they run, but how quick can they stop. A car going 15 miles an hour that can stop with a simple movement of the hand in a car's length, is safer than one going 8 miles that takes three or four cars' length. There is no particular objection to fenders, but for public safety either an electric or air brake should be on every car.

I saw one line equipped with an electric brake, which is a large magnet on the side of two wheels, and gets its power from the commutators, independent of the current from the trolley. One of these cars was running at about 10 miles per hour, when a horse running away threw the driver out directly in front of the car. A fender would not have saved him, but the electric brake did. Another case was a man that did not see the car until on the track, and in his hurry to get off, his foot slipped, and he fell flat on the track, but the brake was applied, and he was not hit.

There were many equally narrow escapes when the line was first started, and the public and motormen were new. The ordinary hand brake would have killed a number.

One trouble in Brooklyn is trying to do too much work on too few streets, and fills the streets with cars, so that if a person escapes a car going one way, he stands a good chance to get caught on the other track.

A lady solved the problem in this way: She stood for some time watching for a chance to cross the street, and finally boarded a car and rode until some of them branched off, when she alighted, crossed the street, and came back safely on the other side.

A car can be reversed, but it requires both hands, a compound movement, and a clear head, a combination not always present.

The electric brake spoken of requires a simple movement with one hand, and simply consists in shutting off the controller, and pushing the handle in the same direction puts on the brake.

If the press really cares for the public safety they should take up the question of brakes, for it is better to stop before hitting a person, than to trust to the exceedingly doubtful efficiency of any fender.

Waterbury, Conn. W. E. Crane.

Oil from Chips—Spring in the Shop.

Editor American Machinist:

A very good oil extractor for recovering that lubricant from lathe chips and borings is in use in a Massachusetts shop, where it was evidently built. The device in question consists of an oil-tight tank about three feet square. It is lined with tin well soldered to prevent leakage. Inside this tank is a coil of ¾ inch steam pipe, and on top of the pipe is a perforated screen. The chips taken from the machines are deposited on top of this screen, and allowed to cook there several hours. The oil being warmed by heating from the steam pipes, drains from the chips much more readily and completely than when they are cool. A filter is placed underneath the wire screen, and the oil is cleansed by the passing through it of the dirt which escapes the oil screen. The maker of this box talks of adding a washing box, in which the oil can be treated to a stream of hot water. At present with only the filter the oil comes forth quite clear, and in apparently good condition to be used again.

Recently I came to a shop where there were evidences of springtime. There seemed to be a general awakening. New machines were sprouting everywhere. Lots of old-time tools seemed to be badly winter-killed. The house-cleaning had also evidently been effected, and much of the old decay and old ruts were filled full of worthless matter, until they were trodden out of all recognition. There is hope for a shop when such a movement strikes it. A gradual regeneration is much better than a sudden one. Men as well as machines stand it better. Some large shops are suddenly put on to piecework at a given date. Many of the old machines have to be retired forthwith and quite a number of mechanics cannot stand the strain, and prefer to go with the old machines rather than start anew. In fact, it is too much like "teaching an old dog new tricks." By the gradual substitution process the same ends are attained, and there is not as much tearing up and replacing.

James F. Hobart.

"Sending Catalogs to Technical Schools" in India.

Editor American Machinist:

I was very much interested to read the correspondence in your very valuable issue of the 23d May and 13th June, 1895, with which I have my full sympathy, and I need not say that I fully concur with the views expressed therein by Mr. C. R. Richards and your friends. I, living so far off from your continent, realize the difficulty more keenly. And without adding anything more of my own, I have only to request you to give room to this my letter in the columns of your paper, so that the name of my Institute in the far East may not be omitted if one undertakes to prepare a list of such technical schools and institutes. And also the manufacturers whom we find too difficult to approach to request sending their catalogs to me can avail themselves of the opportunity of sending their catalogs if they wish at all to do so. L. K. Kirloskar,

Drawing Master Victoria Jubilee Technical Institute, Parel, Bombay, India.

Making Small Punches.

Editor American Machinist:

In regard to A. P. Hyde Machinery Agency's query about a remedy to prevent excessive punch-breaking, would say that if he grinds his punches slightly rounding or spherical on the face he will undoubtedly find it an improvement.

The philosophy of the thing is that it is almost impossible to grind a punch (as ordinarily ground) absolutely square, so as to bring a direct compressive stress in punch, while if not ground perfectly square (with flat end), it brings a bending action into play, which is fatal to the life of a punch.

Edmund Bury.

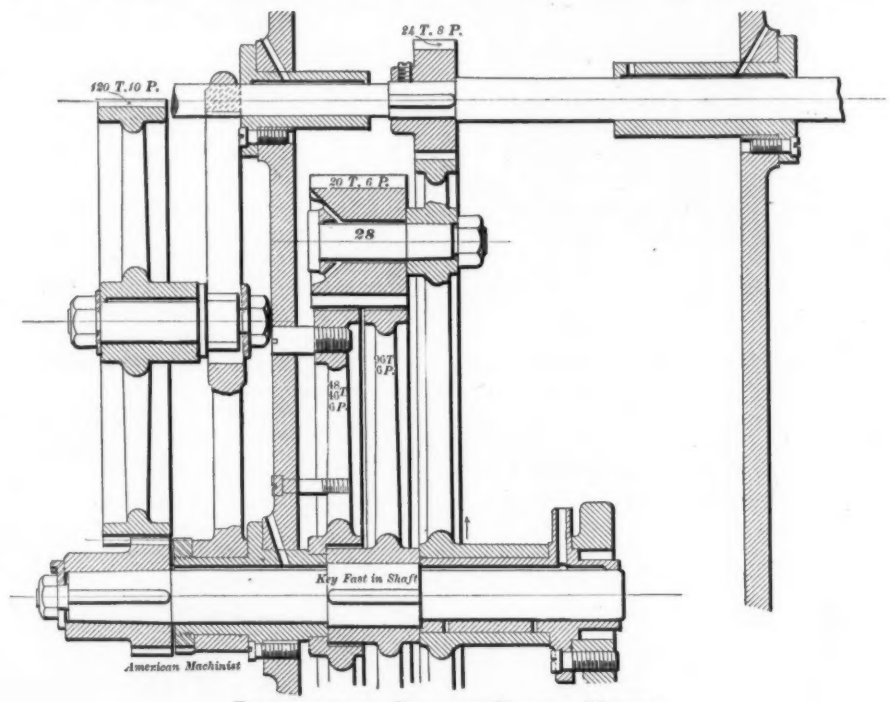
23 Waverly place, Chicago, Ill.

Mr. Balzer's Device for Backing Off Cutters.

Editor American Machinist:

In your issue of July 4th there is an advertisement of a device for backing off cutters, invented by Mr. S. M. Balzer, which recalls a description of a device for the same purpose, and by the same inventor, in your issue of March 28th. I have carefully re-read this description, and I should like to offer the following criticisms:

It states that if the wheel *b* has a few teeth less than *a*, but evenly spaced, *b* will have a slow but continuous motion forward. This is a misstatement, for, if the movable wheel *b* has fewer teeth than the stationary wheel *a*, then *b* will rotate in the opposite direction from the driver *D*. It is also a mistake to suppose that any of the teeth in *b* should be unevenly spaced, because, if so spaced the rotating and the eccentric movements of the cutter will not time together. If made as stated, and the lathe spindle runs forward, the cutter will rotate backward, and during a part of the time it will move away from the tool at the very time when it should be moving toward the tool. It is the wheel *a* that must have the fewer teeth, and it is also the wheel *a* that must have the teeth unevenly spaced.



Differential Sun and Planet Motion.

Wheels unevenly spaced have been used by the Brown & Sharpe Mfg. Co. for indexing purposes. I have somewhere seen in print a scheme for epicyclic non-circular wheels, in which there is a movement and then a dwell. Brown & Sharpe wanted only a slight movement, which did not necessitate non-circular wheels, the uneven spacing of the teeth being sufficient. I send you a blue print of such a set of wheels, dated September, 1889. I saw the alternate movement and dwell scheme some time before this date, I think in some of Professor MacCord's writings. In this scheme there were a forward movement, a dwell and a backward movement.

It is also a mistake to suppose that Mr. Balzer's device will form cutters that can be sharpened in the ordinary way without changing their form, because the device changes the hight of the cutter in relation to the tool, which precludes the cutter's milling work of uniform outline as the teeth wear away and are sharpened. Anyone that has ever formed cutters knows the difficulty, even in the best conditions, of reproducing in the final work the exact form at the beginning. Still I have no doubt that Mr. Balzer's device will form cutters well enough for some work.

It is a little surprising that the *Mechanical World* and a correspondent should have passed over these mistakes. Let us hope that the mechanical reporters for the daily papers, whom we sometimes satirize, will be equally reticent. "Jarno."

[Our correspondent has pointed out an error in our description which had escaped notice. It is, as he says, the wheel *a* that must have the uneven spacing, instead of the wheel *b*, and in the actual construction it is so arranged.

It has often been remarked that "there is nothing new under the sun." We supposed this uneven spacing to obtain an intermittent motion was new. "Jarno's" letter and blue print (the latter showing exactly the same construction) show that we were mistaken. We are not greatly surprised at this discovery, and would not be much surprised to learn that the device is at least a century old.

As to the variation in shape, due to change in relative hight of tool and cutter, this might amount to something worth considering on some work, but ordinarily could be ignored, we think. The eccentricity need be only very small.—Ed.]

Chain Oilers.

Editor American Machinist:

I have just seen Mr. Smith's criticism of the use of chain and ring oilers, and Mr. Cross' defense of the ring oilers. I wish now to give my testimony for what it is worth in favor of chain oilers. I have in constant use about 600 chain-oiled journals, from 2 inches to 5 inches diameter, and running for the most part about 300 revolutions per minute. The majority of these are of Sellers' plain pattern, made for glass lubricator in center and grease hole on each side of center. To adapt these journals for chain oiling, the bottom parts have been drilled, the top parts grooved, and a box or pan of thin cast-iron added, inclosing the whole journal, and also lower part of hanger. The chains are of the bronzed stamped-link kind used for window sashes. With the glass lubricators there were some journals that always ran warm, and occasionally became hot. No journal has got hot while oiled with the chains. Most of the journals have two chains, but a very few required four to make them run cool. Many have been running 2½ years without change of oil. In a few cases the oil has been filtered because it was found that "muck" was collecting at the bottom of pan. A sample of oil after 2½ years' use, taken from an oil pan immediately after its removal from a running journal, shows very little matter in suspension. Where the oil reservoir is large, and chains are not too long, the heavy particles *can* settle. If they did not, the quality of the oil could be maintained by timely filtering. With the arrangement I have described, the pan can usually be taken off, cleaned, refilled, and replaced, while shaft is running.

The chains are not hard to stop, but there should be nothing to stop them. The only stopped chain I have found was stopped by the carcass of a big beetle, which could not have "got there" if the little grease cup had been in place. In this instance *one* chain efficiently lubricated the whole journal, and the stoppage was discovered in course of inspection, not because there was any evidence of trouble.

I have run a shaft at 700 revolutions per minute, doing a good deal of work, and had boxes warm, but got them cool by applying four chains to each box. In this case wipers were used to spread the oil, and I think nothing short of a pump could improve on the lubrication thus obtained.

I have nothing to say in defense of a chain oiler in which the oil reservoir is an integral part of the journal box. It has to be small, and proper cleaning of it is impracticable.

In the system I have described, I believe the cost of pans, etc., is more than paid for by saving in oil and grease alone, not to mention a probable large saving in power.

I have had opportunity to make only one dynamometer test to compare the friction with the two systems of oiling. With journals freely oiled by hand, a certain shaft running 100 revolutions per minute, and transmitting no power, required .75 of one horse-power. On application of oil pans and chains the indicator went back at once to .25 of one horse-power, and stayed there.

J. H. Abercrombie.

76 Fourth avenue, Newark, N. J.

Use of Cyanide in Hardening Tool Steel.

Editor American Machinist:

I would like to know whether there is any advantage in using cyanide in hardening gages made of tool steel, where, of course, surface hardness is the important feature. I wish to know not only if the use of cyanide is unobjectionable, but whether or not it can injure the steel in any way. I am a gage maker, and the excellent blacksmith who hardens my gages prefers to use cyanide on them. We use Crescent extra steel, and it seems to me cyanide ought not to be necessary. Will some of the steel experts give their views on this matter? T. H. M.

[We asked Mr. I. H. Patriarche, the New York representative of the makers of the steel referred to, to throw some light on this question, and he replies as follows:

Editor American Machinist:

In reply to your inquiry of the 30th about the use of cyanide, I do not think it is necessary if all the scale is removed from the steel so that it will harden thoroughly at its normal heat. The cyanide, however, does no harm, and where the steel is used for gages, and a hard wearing surface is desired, possibly the cyanide may be of actual advantage. We always discourage the use of this, or other chemicals, and indeed, in the matter of cyanide, if we were to suggest its use to most tool makers, they would promptly reply that they did not want any steel that had to be case-hardened, and ninety-nine out of a hundred look on it as a sort of medicine for a poor steel—to try and make it do the work of a good steel. Of course, you know this is not the case, and the fact remains that one of the foremost steel hardeners that we know of, Mr. George Ede, constantly recommends the use of prussiate of potash in hardening many kinds of dies, and other tools, for the reason that it gives the desired hardness at a little lower heat than would otherwise be required. We have always felt, however, that it was a good plan to get steel of a little higher temper where great surface hardness was required, and then use care in hardening. So many different kinds of gages are made, that it is rather difficult to give a specific reply covering all cases. If round steel is used, and is furnished of the regular temper, it may be found necessary to heat it to a nice, bright, red heat in order to secure the proper hardness, and cool it in brine. If the heating is uniform the stock will not crack. The cyanide will not injure the steel, and if a man is accustomed to using it, and gets good results, he had better continue to use it rather than make any change in his practice. If one of these case-hardening mate-

rials is to be used, I have such respect for Mr. Ede's practice and experience, that I would advise what he recommends, namely, the yellow prussiate of potash, powdered.

If this reply is not sufficiently explicit for your correspondent, I will be glad to give such information as I can on knowing what sizes of steel were used.

I. H. PATRIARCHE.

Packing Hydraulic Jacks.

Editor American Machinist:

In answer to "H. T.," of Boston, Mass., as to leather and lubricant for hydraulic jacks, I will give my experience.

I had charge of, and was obliged to keep in repair, the jacks on the New Haven & Hartford division of the N. Y., N. H. & H. R. R., and used alcohol (with enough kerosene oil in it to spoil it for drinking, as some of the men were inclined that way), and was obliged to look about for something to prevent the alcohol from cutting the packing. We used Barberry tallow, in place of beef tallow. The process was to melt the tallow, and dip and roll and work the leather until filled, then press while hot into the molds, care being taken that the tallow was not so hot as to burn the leather.

We found that those packings would outlast double any other packing, as the soft or flesh side of the leather was filled and made firm all the way through.

Alcohol was used, as that will not freeze in cold weather, and that is the time when they are most needed; although they are used in the shops and on the road all of the time more or less. W. C. L.

Tempering Steel.

Editor American Machinist:

"P. D." mentions his fad of keeping water till it is two years old to harden steel in. I wonder what arrangement he would have if he had from 100 to 100,000 pieces to harden and temper! All these fads are superstition. Steel that will not produce good results hardened in fresh water is "N. G." I have had 25 years' practical experience, and when I hear men tell of this way and that way and the other way, I grow weary; and as to heating steel to harden, I find that the quicker it can be heated and taken from the fire the better, and I am unable to see what good it does to let it remain in the water at least one-half hour after being cooled. I find a copper plate better to draw temper on, as it does not warp and will not scale like iron. I have no fad—no superstition. Given good steel, good fire, and clean, cold water and the results are "O. K." At least, I have no trouble. I have been in the pocket-knife business 25 years, and think I know just a little bit of the working of steel. I am willing to give to anyone any information that I am able, but for me no concoctions to harden in; and, while charcoal is a good material for fire, I had just as soon have a good coke fire, made by myself from any kind of soft or bituminous coal. There are places where charcoal is not obtainable; then use a liberal amount of good, practical common sense, and things will be "O. K."

Chicago, Ill. A. W. PHILPS.

The Angle of Projection.

Editor American Machinist:

If discussion is still in order I beg to submit a few thoughts from one of those greasy workmen, for whose untutored but *not* untortured imaginations so much has been written and so little done.

It seems to me that many of the attempts to straighten matters in regard to projection have been made by persons who have held for a longer or shorter time some very settled notions, and though thinking themselves open to conviction they, in common with the Dutchman famed in story, never expect to find the man that can convince them.

Oberlin Smith, in AMERICAN MACHINIST of July 18th, adopts the terms indirect and direct revolution, and I wish to show that through the unsophisticated eyes of the unimaginative, one may be as *direct* as the other—that the sliding process, he says, is necessary in so-called third-angle projection is so only because of a too vivid imagination on the part of the slider. He has given us a very clear idea of a direct way to arrive at the arrangement of the different views of an object in using the so-called first angle, but when he attempts third angle he seems to lose sight of his usual direct methods and take to sliding. He suggests using an object held in the fingers above the paper; we will adopt that method and show the third angle as direct and unimaginative as the first angle.

Take as an object to be drawn any rectangular solid of convenient size and weight—we used a small cubical pasteboard box—mark its faces as follows:

Mark one "Bo" for bottom; hold cube with that face down, and any adjacent face

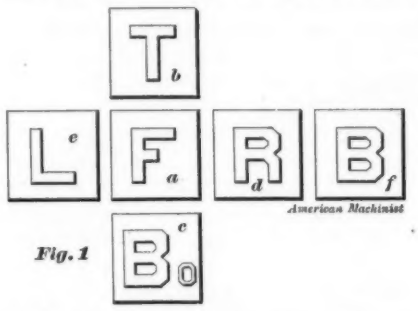


Fig. 1

in full view, mark it "F," front; turn *c* on vertical axis to left ¼ revolution, mark next face "R," right; turn again ¼ revolution and mark the face that appears "B," back; turn as before and mark the next face "L," left; now revolve *c* 90 degrees on its horizontal axis, top toward you, and mark the remaining face "T," top. Now we will proceed to obtain the so-called third-angle views seen in Fig. 1, by *direct* revolution. Hold the *c* with face "F" in full view, and we have front view *a*; consider each edge of face "F" as a possible axis of revolution, and first revolve *c* 90 degrees around top edge, top toward you, and you have top view, *b*; then from first position (*a*) revolve *c* 90 degrees, bottom toward you around bottom edge, and you have a bottom view *c*; from position *a* again revolve *c* 90 degrees to right around left-hand edge and you have left-hand view *e*; from *a* again turn *c* ¼ revolution; this time to left around right-hand edge, and you have right-hand view *d*; and if a back view is wanted from position *d* revolve *c* 90 degrees to left, around right-hand

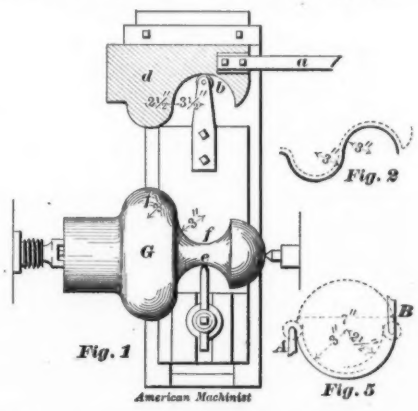


Fig. 1 *Fig. 5*

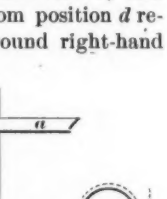


Fig. 2

edge, and we have back view *f* without even using an imaginary axis. In the drawing the views are slightly separated for clearness, but nothing of the kind is thought of as we turn the cube in our hands, because only one face is in sight at once. In the opinion of the unimaginative greasy workman, many views of one object are only necessary when fewer fail to clearly show its form, etc., and not having trained his imagination to see planes extended from the object held above the paper till they meet it, and there form, at the line of meeting, an axis of revolution which will make the top face show below the front and the right-hand face show to the left, etc., he very much prefers to dispense with a method that requires such a use of his untutored faculty.

I do not claim to discard the use of imagination in such matters, but feel that very often the naturally gifted and trained thinkers in any line, when trying to help the untrained, fall into the error that the man did who said, on seeing a picture entitled "Adam Naming the Animals," "Why, he had no need to name the pig, we'd all know what to call him!" I feel that the above method should, because of dispensing with all imaginary planes, walking around, climbing over, digging under, etc., recommend itself to all the untutored and, for their sake, and the sake of uniformity, those with special gifts and special training. UNTUTORED.

Turning Curved Shapes.

Editor American Machinist:

As simple and well understood as are the ordinary operations of the modern lathe, yet by ingenious devices of one kind and another, its range of usefulness is constantly being increased.

From among such special appliances, I single out one which is, doubtless, well known, but is so imperfectly carried out sometimes that the results are anything but satisfactory.

I refer to a device for turning irregular and spherical shapes, by means of guiding forms connected in various ways with the cross feed, or tool post block.

In Fig. 1 is shown a simple plan for attaching such a device at the rear of the lathe carriage. The form *d* is securely attached to the foot stock by the bar *a*, and as the rest is drawn back and forward, the movement of the cross rest in a transverse direction is controlled by the shape of the form. The roller *b* is held against the form, either by a weight or spring, whichever may be most easily applied.

I have selected for the form *d*, that of an ogee, or letter *S*, in order to be able to make clear some of the intricacies involved, which sometimes puzzle the lathe hand. It will be seen that the form *d* and the piece *G* on the lathe centers have not the same shape. If it were desirable to have them conform in shape, then the point of the turning tool *e* must be curved to the same radius as that of the guide roller *b*; but as such a shape would be impracticable for some kinds of work, it is best to reduce the point of this tool to, say, ¼ inch radius, or ½ inch wide at the point. Then with a guide roller of ¾ inch radius, we find the work produced will be unlike the pattern *d*. In other words, the template is modified in form to suit the

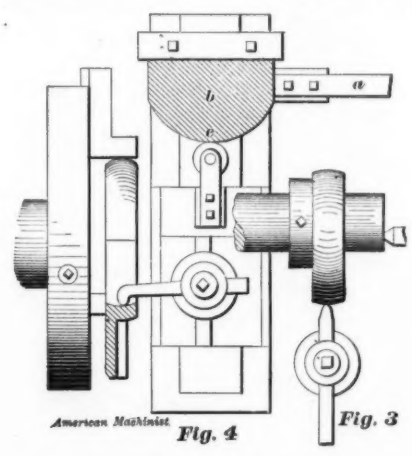


Fig. 4 *Fig. 3*

uniform curves of *f f*, which, in this case, are 3 inches radius.

This result is secured by finding the difference between the radius of the guide roller *b* and that of the cutting tool. This being ½ inch, we must add that amount to the concaved portion of the form *d*, and deduct the same from the convex side, thus making their respective radii 2½ and 3½ inches, as shown by Fig. 1.

The action of the roller and tool may be made a little more clear by the cut at Fig. 2, which shows by a heavy line the course followed by the tool *e*, and that described by the roller, by a dotted line which conforms to the template *d*.

In Figs. 3 and 4, some operations along this line are shown which involve conditions not found in the foregoing. These cuts represent an eccentric and yoke being turned to a spherical form, so that their wearing surfaces will exactly coincide.

We find here a different set of conditions from those of the first example. A convexed form at *b*, Fig. 1, is to be used for haping both the eccentric and the yoke, the latter, of course, being concaved. To illustrate this we will adopt the same sized tool and guide roller first used; that is ¼ inch and ¾ inch radii. In Fig. 5 is shown an outline of the eccentric and yoke as though they were complete spheres, and assume them to be 7 inches diameter. The point of a turning tool is shown at *A* in position as it would appear after taking a finishing cut from the eccentric. From the center of this tool the outline of the guide roller is shown by a dotted line, and touching the periphery of this is the form for guiding the roller. It is readily seen that the radius of this form is 3 inches, or as much smaller than the eccentric, as the radius of the roller is greater than that of the turning tool, so in this case the diameter of the form is 6 inches.

At *B* a tool is shown in position for turning the yoke, and the guide roller outlined around it. Taking the radius of the form for shaping the yoke here, we find it to be 2½ inches, which is 1 inch smaller than that of the yoke, or a difference between them of 2 inches in diameter. Thus two forms are made necessary for these operations, one an inch larger than the other, and both smaller than the circles generated by them.

Another important element enters into this operation which is not found in the first.

The desired curves in the piece *G*, Fig. 1, are secured without reference to any particular diameter, but in the case of the eccentric and yoke, it is obvious that their diameters must conform to those of the templates used, the templates first having been made to suit the desired diameters of the yoke and eccentric. Otherwise a truly spherical shape could not be secured for these parts, nor could they be expected to fit each other, or have that freedom of movement which correct work of this kind should permit.

There is one more place on a job of this description where a workman may slip up. He may not have the turning tool so adjusted that its center, and that of the guide roller, will arrive at the apex of their respective curves at the same time. Should this be the case, the work may be found to be a little luney, that is to say, the sides of the eccentric and yoke may not, when put together, stand flush on either side.

"QUIRK."

Literary Notes.

EVOLUTION OF THE AIR BRAKE. A brief but comprehensive history of the development of the modern railroad brake, from the earliest conception contained in the simple lever, up to, and including, the most approved forms of the present day. By Paul Synnestvedt.

The subject of which this book treats is fully outlined in the title as given above. The historical sketch commences with the early lever brake used in 1630, and then traces the different kinds of railroad brakes and their modifications in design up to the most approved form of the present day. The whole matter is presented in a simple and concise style, making the book—from an historical standpoint—an extremely interesting one, and from an engineer's standpoint, a very valuable and instructive one, as it deals considerably with details of the modern brake. We believe that no engineer, fireman, or anyone interested in the evolution of the air brake will be disappointed in, or regret a careful perusal of, its pages. The book contains 112 pages, 5¼ by 7½ inches. It is published by *Locomotive Engineering*, 256 Broadway, New York. Price, $1.00.

HALL'S INFRINGEMENT OUTLINE. By Thos. B. Hall, of the Cleveland Bar.

This is a book adapted to the use of inventors, manufacturers and others interested in inventions as well as patent solicitors, and its object is to provide an outline of the doctrine touching infringement of patents, that is now settled by our tribunal of last resort. The author's previous book, treating the subject of infringement more in detail, is regarded as a standard authority, and there is every reason to believe that the work now before us will meet with an equally favorable reception. The subjects treated are: License Under Patent, Identity of Invention, Validity of Patent and Recovery for Infringement. The subjects are sub-divided and systematically presented, and there is a full index. The book is published by Banks & Bros., 20 Murray street, New York, is 5½ inches by 8 inches, 93 pages, bound in cloth. Price, $1.00.

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Inspection of Material at Rolling-Mills.

It is customary to write specifications defining the qualities and properties of metals to suit the particular objects sought to be attained by engineers. As structural materials vary in accordance with the materials and methods used in their manufacture, and are moreover subject to accidents in their production, it becomes necessary to test the material in general as to its qualities, and also to inspect the individual pieces and reject those affected by accidental defects.

The engineer thus sees to it that the material is what has been ordered, but he is not supposed to, nor does he, make suggestions in regard to how such material is to be made, as that is the business of the mill management.

When building structures engineers generally contract with a bridge company, providing specifications which are to be its guiding law. These generally contain a clause providing for ample opportunities and facilities for testing and inspection; but as inspection and testing the material at the bridge shops cause delay and great expense, it has become the custom to send inspectors to the rolling-mills, while the material is being rolled, to pass upon it before shipment to the bridge works, which may be several hundred miles distant. It is easy to replace rejected pieces of material at the rolling-mills, and causes little loss of time.

The inspector selects and marks suitable crop ends from which test pieces are cut and properly prepared. As it is an established fact that steel gives better results 24 to 48 hours after rolling than when tested immediately, and as it takes not less than six to eight hours to prepare the test pieces, the material should be and always is on the shipping bed hours before the first test can have been made.

The inspector should not waste time and labor by examining each individual piece for surface defects before he knows whether the quality is acceptable, as this would cause the mill unnecessary labor in handling the material; but he should first examine the qualities, and then when these are found satisfactory proceed to inspect the individual pieces for perfection, at the same time stamping each accepted piece for future identification. It is apparent that this stamp of acceptance should not be applied before the quality of the material is known; hence if it be examined for surface defects while passing through the shops, which must be many hours before it can have been tested, it will either become necessary to dispense with stamping the material or else to handle it a second time to apply the stamp after tests prove it to be satisfactory.

It seems strange that in spite of the above explained routine and facts the Carnegie Steel Co. should have issued their recent circular to engineers, in which they state that mill inspection must be done while the material is passing through the shops, and will no longer be permitted to be done on the shipping beds. If not done as they indicate they propose to issue inspection certificates which must satisfy the purchaser.

It is well known that no mill furnishes sufficient light for proper inspection after dark, and that many defects are visible only in a strong light; still the Carnegie Steel Co. insists that inspection must be done at all hours of the day and night, because the material rolled at night will have reached the shipping beds in the morning, where they refuse to allow it to be inspected.

But even if it were possible to inspect properly by a poor light, it would require the constant presence of an inspector at each roll train or straightening press; hence three men, each working in eight-hour shifts, would be required. Whereas by the usual methods one inspector can inspect the entire product of not less than three roll trains in one day of eight hours, the proposed new plan would require the employment of not less than nine men partly employed, to take the place of one man fully occupied; for which the buyer must, of course, pay if he desires his material to be inspected, and this heavy expense is demanded by the Carnegie Steel Co. to save the expense of one gang of laborers and to expedite shipments. Moreover, any genuine inspection in the mill would often completely blockade operations, as rejected material could not be promptly and properly separated from that which is satisfactory. It is not unlikely that the action of the Carnegie Steel Co. will result in the demand for inspection of finished material at the bridge shops, thus causing them delay and expense.

It has also come to our knowledge that the chief engineer of an important Western railroad has rejected a lot of material because the Carnegie Steel Co. refused to allow inspection at the shipping beds, although the contract for this material, guaranteeing ample opportunity for inspection, had been made before the new circular had been issued. The value of a mill certificate of inspection can well be realized when it is remembered that the term of employment of the mill inspector depends entirely upon the amount of material he can pass off on purchasers, and upon his failure to reject defective material, thereby decreasing the amount of scrap and increasing the prospective profits of the mill. He must of necessity always act in the interest of the mill, or make way for another inspector. We do not believe that the Carnegie Steel Co. will be able to enforce their new rule as laid down in the circular, for any great length of time, as it imposes unnecessary hardships upon purchasers and users of materials.

The Problem of the Brake Upon the Trolley Car.

This problem still stands unsolved. Our esteemed and able contemporary *Electricity* very kindly gets up and says what it is possible to say upon the subject of "The Braking of Trolley Cars." We are much pleased to have provoked something authoritative and something up to date upon the above topic. We are not ignorant of the fact that various things have been said at various times in the electrical journals upon the general subject of brakes for trolley cars, and the details of their construction, although during, say, the last three or four months, when the secular press has been so excited upon the safety, or, rather, the unsafety of the trolley car, the electrical journals have been singularly and noticeably silent about the brake or anything pertaining to it. *Electricity* says: "Nor is it the fault of the electrical journals that our contemporary never saw the problem of brakes considered or enunciated in the electrical journals." That is not the problem that we are talking about, and it seems to be necessary to reiterate "the perplexing problem of *how to operate the brake upon the electric car so that an electrically propelled car shall be as safe as any other, so far as the stopping of it is concerned.*" If that problem has been "enunciated" or "considered" by any electrical journal, will someone kindly tell us where? Will *Electricity* refer us to any mention of it in its own columns? It would be a great relief to our minds, and a great assurance of safety to the general public, if anyone would assert and prove that it is not true, as we asserted, that "an electrically driven car upon a street railway, a trolley car, either an overhead trolley or an underground trolley, and especially, and for an additional reason, a car operated by a storage battery, cannot, either of them, *with safety to itself*, be stopped as quickly as any other car of the same capacity, and running at the same speed."

We asserted that the brake in use upon the trolley car is a slow-acting affair, and that it is purposely made so for the safety of the car mechanism. *Electricity* says: "This is only partly the truth. The mechanical brake is a slowly acting affair, *and purposely so*, but not for the reason assigned. The large angular movement of the brake handle is provided simply and solely for the purpose of mechanical advantage, and not for the protection of the gearing as supposed." "Suddenness of application of the brake is not always or usually a requisite to a good brake. Were this so, the blocking of the wheels would be the most efficient emergency stop." Why wheels are blocked is because too much force is applied, and not at all because it is applied too suddenly. "Mechanical advantage" is a disadvantage when it makes the wheels slip. As a matter of fact, as anyone may observe who will ride a block or two on a trolley car, the motorman to apply the brake makes a complete turn with the long crank before he feels the brake, and the tension is then gradually applied by a series of ratchet movements, so that there is neither suddenness nor immediate excessive pressure possible. "The chief difficulty with electric cars is their greater weight." How about a cable car with a trailer attached and both crowded with passengers, yet brought up standing by a movement of a lever not exceeding 30 degrees? Where is the electric car that its builders and owners would allow to be stopped as suddenly as the cable cars are often stopped?

Of course, the motorman's most important function, that of a scapegoat, is fully operative in this case: "Although by the present means of braking, a car can be brought to rest from a speed of 10 miles an hour within a distance of 10 feet" (the car would go more than 10 feet before the brake as usually applied on the trolley car would begin to bite) "if the braking mechanism be guided by proper intelligence, it is exceedingly doubtful if the number of accidents would be much lessened by any improved mechanism which would render stoppage possible within half the distance, unless there were a higher intelligence behind it than that usually found on our street cars." We have not the time or patience to discuss the abused motorman here. As far as the brake is concerned, it is a complete begging of the whole question.

Wet and Dry Steam.

Five or six years ago the calorimetric determination of the percentage of moisture in the steam used was considered essential to a properly conducted test. Recent experiments, however, indicate that little reliance is to be placed upon the reading of the calorimeter. Not that the calorimeter does not give accurately the percentage of water in the steam it receives, but that it appears to be impossible to devise a means of securing a fair sample for the calorimeter. The statement by Professor Jacobus, of Stevens Institute, that if he were called upon to determine the percentage of moisture in the steam used by an engine, he would put in a good separator next the engine, weigh the water thus collected and consider the steam dry which the engine received, best illustrates perhaps present opinion on this point.

Saturated steam does not necessarily contain moisture. Mechanically entangled moisture may be present, but it is not in any sense combined with the steam and tends to separate from it. In a horizontal pipe, it appears from experiments made by Professor Jacobus, that the water runs in a stream along the bottom of the pipe, and that the steam above is perfectly dry. In vertical pipes it appears to splash from side to side, and, according to Prof. R. C. Carpenter, the only certain method of distributing the water uniformly over the pipe section is to put in a diaphragm of fine gauze, and thus cut the water into fine spray by the flowing steam. As this gauze would hardly be applicable to pipes in use, it would seem almost impossible to devise a thoroughly reliable and practical method of sampling.

Vague or erroneous ideas in regard to the condensation of steam seem to be quite prevalent. One reason of this is that seeing steam condense into clouds when exhausting into the atmosphere, we suppose a similar state of affairs to exist in the pipes and cylinders of our engines. Such, however, is not the case, because neither steam nor any other gas can condense throughout its mass' but always condenses upon a surface. Lord Kelvin has shown mathematically that it would be impossible for a globe holding only a small number of water molecules to hold together at all, and since the steam

would have to pass through this stage to condense throughout its mass, it would be impossible for such condensation to occur. This calculation has also been made by Robert von Helmholtz, and confirmed by his experiments and by those of Mr. John Aiken, of Scotland, and Mr. Richardz, of Germany. These experiments have been so carefully conducted, and most of them are so easily repeated that the inability of water vapor to condense, except upon a surface, is one of the apparently settled facts of modern science. One immediately asks how it is that the exhaust steam forms clouds, and that we ever have rain. Both of these are entirely due to the minute particles of dust and micro-organisms ever present in the atmosphere, and it is upon these that condensation takes place and that clouds are formed. When the condensation on the particles becomes so great that they will no longer remain suspended in the air, then it rains. Exhaust steam will form no cloud if blown into a space free of these particles, and no rain can occur in a dustless atmosphere. The experiments are absolutely conclusive on these points.

It is of interest, therefore, to the steam engineer to recognize that as soon as the flowing steam has cleared the pipes and cylinders of air and dust particles, all condensation must occur on the surfaces exposed to the steam. It forms on these like dew, and, trickling down them, follows the course prescribed by gravity and the flowing steam current. The importance of the nature and condition of these interior surfaces has lately been recognized by the finishing and polishing of pistons and the interior surfaces of cylinders where high economy is guaranteed; which shows that the practical man has not been much behind theory in this matter.

As was to be expected, the arrangement entered into between the Baldwin Locomotive Works and the Westinghouse Company is being made the occasion of a good deal of wild talk about its significance, and we hear much of "the coming locomotive" from men who know next to nothing of the going one, and still less of the one that is coming.

In the meantime we are able to get surprisingly little definite information regarding the relative economy of electric locomotion in service for which steam locomotives have been used. It is, of course, true that we have not yet had sufficient experience to draw general conclusions on this point, but the little experience that has been gained is not public property by any means. We know next to nothing regarding the economic results of the Intramural road, and nothing of the elevated road in Chicago that is operated by electricity.

So far as can be judged from what the elevated roads in New York are doing, or rather we should say, perhaps, not doing, electric motors for such service will be improved somewhat before it will pay to discard steam locomotives already in use; the significant fact in this connection being that very much of the capital that is invested in the New York elevated roads and that invested in the Westinghouse Electric Company, belongs to the same individuals, and there is every reason to believe, therefore, that the roads here will be equipped with electric motors as soon as considerations of relative economy and general desirability make it advisable.

Literary Notes.

We have received from the secretary, Angus Sinclair, the printed report of the twenty-eighth annual convention of the American Railway Master Mechanics' Association, held at Alexandria Bay, Thousand Islands, N. Y., June 17th to 19th. It contains, as usual, very much matter of the highest value to those who have to do with the building or repair of locomotive engines, composed, as it is, of papers and discussions of them by the leading men who are responsible for such work. It is standard size—6 inches by 9 inches.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

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(314) G. W., Pittsburg, Pa., writes: Kindly inform me where I can find a table of secants for each minute of an arc. *A.*—You will find a table of secants in Kent's or Haswell's mechanical engineer's pocket-book.

(315) N. S. L., Milwaukee, Wis., writes: Please inform me of some good books treating on laying out sheet iron work and boiler work. *A.*—"The Theoretical and Practical Boiler Maker," by S. Nicholls, is considered to be a good book.

(316) H. J. M., Dayton, Ohio, asks: If I am told to cut a $\frac{3}{4}$ keyway in a shaft, how deep should it be, and from where should I measure? *A.*—You should make the keyway $\frac{3}{4}$ inch wide and $\frac{3}{16}$ inch deep, measured at the side of the keyway. If there is a local shop practice that calls for a different depth, then the required depth should be stated when the order is given.

(317) L. F., ——, R. I., writes: Please let me know in what issue you published the method of finding the diameters of cone pulleys. If they have appeared in papers which you cannot furnish, would you kindly reprint the same. *A.*—The method of finding the diameters of cone pulleys was published in our issue of December 1, 1888. We cannot furnish this issue separately, but it may be obtained in a bound volume. We cannot promise to republish it.

(318) B. M. M., Passaic, N. J., writes: Some time in 1881 you printed a table computed by S. W. Thompson to aid in finding the steam consumption in pounds per horse-power per hour as accounted for by the indicator. Now this is for a simple engine. Please explain how this table can be used for finding the steam consumption per horse-power in compound engines. *A.*—Use the indicator card taken from the low-pressure cylinder, and then proceed in precisely the same way as for a simple engine.

(319) W. E. C., Moline, Ill., writes: I was very much interested in your description of the Hornsby-Akroyd oil engine, but notice that you fail to state kind of oil used. Please state the kind of oil, and what test. *A.*—The oil used is the common kerosene of the stores. The flash test may be anywhere from 100° to 300°. We saw the engine running with oil of 150° test. 2. Would you also favor me by giving directions for laying out elliptical gears? *A.*—A description of the process appeared in our issue of September 25, 1890. Any directions for such an intricate operation would be too long for reproduction here.

(320) B. R, Bielefeld, Germany, writes: Please state a good way of cleaning or preparing small castings for a nickel bath. *A.*—Immerse the castings in a solution of 1 part sulphuric acid in 10 parts water. On withdrawing the castings from the acid solution they should be dipped in a bath of hot lime water, and held there till they become so heated that they will dry immediately when taken out, and finally rub them with dry bran or sawdust. 2. Which is a good way to color large quantities of polished steel articles, by heat, or by heated oil, etc.? *A.*—You cannot color them by heated oil. They can best be colored by heating them in a bath of fine, clean sand, which is kept in motion during the heating in order to distribute the heat evenly.

(321) Apprentice, Newark, N. J., writes: In Question 306 you give the formula $n = \frac{p \times N}{P}$ for calculating the number of teeth the gear on the screw must be turned in cutting double and triple threads. In calculating the number of teeth the gear must be turned in cutting a nut 4 to the inch double with lead screw 2 to the inch, and gear on screw 150, you get $n = \frac{.25 \times 150}{.5}$ = 75. Please let me know what the difference in the equation would be if the nut were 4 to the inch triple. *A.*—There would be no difference.

(322) "Vermont," ——, asks: Would the depth of teeth in a gear cutter alter the speed of the gears cut therefrom, for instance, a pair of spur gears have a given speed, by using a deeper toothed cutter would the speed of a similar pair be altered by a deeper tooth of one, causing an improper meshing? *A.*—We are not quite sure that we understand your question, but suppose you refer to the depth of cut taken in the gear blank by the cutter, and if this is what is meant, then we reply that differences in depth of cut will make no difference in the rate of speed, the only effect being, if the cut is made too deep, to make the teeth thinner than they should be in the gear, and it would cause an improper action and probably a good deal of noise with irregularity of motion. The number of revolutions in a given time, however, would remain the same as though the teeth had been cut to a proper depth.

(323) A. S. C., Boston, Mass., asks: Where can I buy diamond drills? How are they made and what are they used for? *A.*—The diamond drill is principally used for boring in rock, either in prospecting for mineral deposits or for the foundations of important buildings and similar engineering work. The drill proper is a steel tube upon the lower edge of which are mounted several diamonds which do the cutting, some of the diamonds slightly overhanging the outside and the alternate ones cutting for the inner edge of the tube to clear. The drill is revolved at a considerable velocity, and a stream of water is constantly fed to it to wash away the cuttings, which are usually dust. As the drill is fed forward a central core is left which can be removed in long sections as reliable specimens of the strata penetrated. The drill tube is successively spliced and penetrates to depths of several hundred feet. For simple drilling the regular rock drill is cheaper and quicker in operation. In accordance with the general American practice, the term "drill" applies to the entire apparatus.

(324) J. D., Streator, Ill., asks: How much pressure will it take to punch a hole 8 inches in diameter through a sheet of steel $\frac{1}{4}$ inch thick; one edge of the punch is $\frac{1}{4}$ inch ahead of the other? *A.*—The pressure will depend on the quality of the steel and condition of the punch. Under favorable conditions it may require 50 tons. This must be considered as an approximate estimate only. 2. In copper plating small steel articles, I dip them in a solution of one part of blue vitriol dissolved in three parts of rain water, but the copper rubs off very easily. How should it be done so that the copper will stay on? *A.*—The articles must first be well cleaned, and then painted over with a solution of proto-chloride of tin, and immediately afterward with an ammoniacal solution of sulphate of copper. The layer of copper thus produced adheres so firmly to the iron or steel, that the different objects can be rubbed and polished with fine chalk without injuring the deposit. The tin solution is prepared with one part crystallized chloride of tin, two parts water, and two parts hydrochloric acid. The copper solution is prepared with one part sulphate of copper, 16 parts water, adding ammonia sufficient to precipitate and redissolve.

(325) J. F. B., Spokane, Wash., writes: Please explain the cause of the groaning in a steam cylinder of a steam pump used for elevator service. Every now and then we hear a short r-t, r-t, r-t, then at every stroke r-t, r-t, and then a long drawn r——t which always makes the engineer look for a 20-pound sledge hammer, and the people on the fourth floor greet each other with "going to have a storm." It certainly cannot be for the want of oil as we use $1\frac{1}{2}$ pints in 16 hours, the pump is 12x10x7 inches. Another queer thing about this noise is that it is generally confined in one cylinder, the pump is of the duplex type. I know several pumps which run in the same way. *A.*—It is difficult to locate the cause of the noise without examining the pump and without knowing the builder's name. But from the description you give we are inclined to believe that the cause of all the trouble is due to steam valves which are lifted off their seats at every stroke of the piston and make the rattling noise to which you refer. A close examination should reveal the cause, and the sooner that this is done the better it will be for all concerned. The builder of the pumps may be able to point out the cause without much labor.

(326) Engineer, Philadelphia, Pa., asks: Does the fact of having declared your intention of becoming an American citizen qualify for examination for an American marine engineer's certificate? *A.*—It does, provided you have been a permanent resident of the State for six months. 2. Will the holding of the highest certificate issued by the British Board of Trade be considered a qualification? *A.*—It will be considered as a proof that you have had experience. 3. Where and by whom are the examinations held? *A.*—The examinations are held by the supervising inspector of steam vessels in your district, or by any local inspector of steam vessels, at any time you present yourself. 4. Can a candidate go up for a chief engineer's certificate without having held any of the lower grades? *A.*—If you show the highest certificate issued by the British Board of Trade you can get a chief engineer's certificate, provided you can pass the examination, which you will have to pass under any condition. If you have not a certificate from the British Board of Trade you will have to get experience in the lower grades first.

(327) H. C. W., Lockport, N. Y., writes: I have a small steam yacht in which there is a simple engine with cylinder $3\frac{1}{2}$ inches diameter and $3\frac{1}{2}$ inches stroke. I desire to change the engine into either a steeple compound using one of the present cylinders and all the other parts of the engine, and simply adding a low-pressure cylinder, or make it into a fore and aft compound using a 4x4-inch high-pressure cylinder and $7\frac{1}{2}$x4 low-pressure cylinder. Which will be the better type to use, and how much more power will I get with the compound than with the former simple engine? Will there be a saving in fuel? *A.*—We prefer the fore and aft type of compound engine and should make the high-pressure cylinder 4 inches diameter, low-pressure cylinder 8 inches diameter, and both 6 inches stroke. With the compound engine there will be a saving of fuel, in fact, this is one of the principal objects aimed at by the adoption of the compound engine. Since we do not know the power developed by the simple engine, and have no data for computing it, we cannot say how much power you will gain. The compound engine when running with an absolute initial steam pressure of 135 pounds (120 pounds by gage), and at a rate of 350 revolutions, should develop about 13 horse-power, non-condensing.

(328) E. B., Toronto, Canada, writes: Which is the best method of making rust joints? I have over 1,000 feet of 3-inch boiler tubes to put up overhead in our factory. I have never made any rust joints; kindly inform me what to use and how to use it as packing around flanges. *A.*—If rust joints are to be used for the above boiler tubes, we pity the man that has the job. Rust joints are usually made with sifted cast-iron turnings, sal-ammoniac and a little sulphur mixed to a rather stiff paste with water and packed into the joint with a chisel or calking iron. One part sal-ammoniac, 2 flowers of sulphur and 80 of iron turnings, by weight, is given for quick setting and 1 sal-ammoniac, $\frac{1}{4}$ sulphur and 100 of iron for slow setting. It is better to omit the sulphur entirely. 2. What will be the best thing to put on top of exhaust pipe that will cause enough back pressure to make steam go through these 1,000 feet of tubes without affecting the engine, which is 150 horse-power? We are going to tap exhaust pipe about 20 feet below roof. *A.*—Of course, any back pressure in the exhaust pipe will be back pressure upon the engine piston, and a reduction of engine power to that extent. We would put a long bend upon the upper end of the exhaust pipe, turning it to a horizontal position, and have the end beveled at an angle of about 45 degrees. Then a valve may be placed over the end of it with a horizontal lever that may be weighted for any pressure required, or the valve may be swung up out of the way to leave the exhaust free, when desired.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 672.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Marine Iron Works, Chicago (new catalog).

Patent Solicitor. J. G. D. Mack, Madison, Wis.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Wanted—Machinery to build: special. steam, mill, hydraulic. F.C. & A. E. Rowland, New Haven, Conn.

American packing rings are in touch with the cylinder. New circular about rings and pistons. J. H. Dunbar, Youngstown, O.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

Instructions for the Boiler Room (5th Ed.), by Hawkins. Price $2 50, catalog free. Theo. Audel & Co., 91 Liberty street, N. Y.

I make aluminum castings $\frac{1}{32}$" thick. If you have been disappointed in your castings, try me. Twining Campbell, Brass and Aluminum Founder, Paterson, N. J.

Just Published—"The Modern Machinist," by John T. Usher. Price, $2.50. Each of its 257 illustrations represents a new device in machine shop practice; a new book from cover to cover; agents wanted in every machine shop; send for special illustrated circular. Norman W. Henley & Co., 132 Nassau street, New York.

Making a Three-Way Cock.

By P. S. Dingey.

A three-way cock seems an ordinary piece of work when finished, and requires but little more machine work than a straight-way cock—facing one flange and drilling being all the extra work required. The same, however, cannot be said of the molding, neither is the patternmaking such an elementary job as the castings might indicate.

Figs. 1, 2 and 3 are three views of the cock which it is proposed to make. Fig. 1 is an outside elevation, Fig. 2 a section of Fig. 3 through *L M*, and Fig. 3 a section of Fig. 2 on *J K*; the plug in Fig. 3 is not projected from Fig. 2, but is turned around to show the opening 2¼ inches by 1 inch.

There is no better way than making a *pattern* for a straight-way cock, but for a three-way body or shell a core box may be substituted for a pattern, and made to answer the molder's purpose better than a pattern. To a molder or patternmaker the disadvantages of a pattern for the shell are known, and without discussing them we will consider the method given here.

Figs. 4 and 5 are sectional views of the mold, the outer part consisting of three cores numbered 1, 2 and 3 respectively, and joined on the radial lines *D E F* in Fig. 5. The center and passage core on line *F* are in one, the passage cores on *D* and *E* are separate and set into the center core. When locating these cores the center one is first set into the slab core as represented in Fig. 4, then No. 1 and No. 2 in Fig. 5 are set, and these being joined at *F* will support the passage core on that center line. Before No. 3 is set the cores on *D* and *E* must be set into the center core and held in place until No. 3 is located. The ends of cores on *D* and *E* are made to project so that the molder may either block up the ends, or have a boy to hold them while setting No. 3. When all have been set a flask is dropped over them and rammed around with sand.

The core boxes from which the cores are made are shown in Figs. 6, 7, 8 and 9.

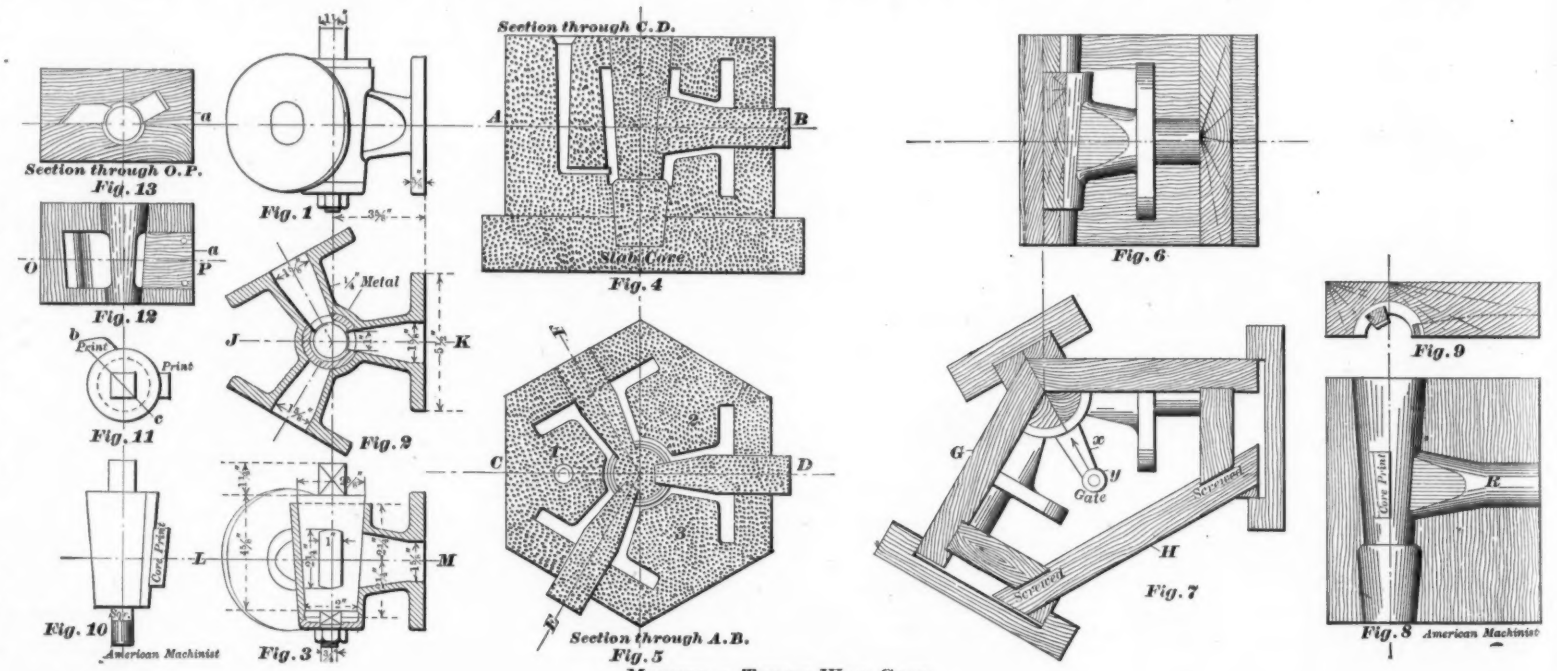
The two views in Figs. 6 and 7 represent the way in which box for outside cores may be constructed; Fig. 6 shows the inside with *G* and *H* removed. Figs. 8 and 9 show the box for the center and one passage core. The box for cores on *D* and *E* is not shown, it being identical with the part *R* in Fig. 8, except that it is made longer for setting into the center core, and for projecting ends.

The first of the boxes is made as shown in Fig. 7, and is held together by three clamps while the core is being rammed; the box is screwed together in two places only, as marked, and when the core is rammed up is taken apart at the three corners not marked, "screwed." The gate shown is, of course, used only for one core, *x* is separate from *y*, and is drawn out in the direction of arrow when all the parts of the box have been taken away from the core.

In order to make the center and passage core together, as shown in the mold, another half box similar to that shown in Figs. 8 and 9, but the opposite hand to it, should be made. One-half could be made to answer by cutting *R* in Fig. 8 on each side of center and using a stop-off piece alternately for stopping off *R*, and changing over the core print which is doweled on, but it is more profitable to make another half box, doing away with the changing and thus preventing mistakes.

The plug for the three-way cock has two openings 2¼ inches by 1 inch, placed at an angle which coincides with the two passages in the shell (120 degrees); the thickness of the metal in the plug is the same as that in the shell. To make this casting a pattern is used, though it could be made altogether with cores like the shell, but a pattern in this case is probably a better method. It is shown with core box in Figs. 10, 11, 12 and 13. The pattern is parted on *b c*, Fig. 11. It will be seen that the core print near *c* would not draw if fastened to the pattern, it should therefore be located with loose pins to permit its being drawn separately, or a section of one-half of the pattern may be arranged to be left behind in the mold and also drawn separately, having the print attached to it. At *b* the print is beveled to allow the core to be set in on an angle.

The core box is made as shown in Figs. 12 and 13, with piece *a* put on with two pins and held in place by one screw while making core. The core being made the screw is taken out, leaving the loose piece *a* behind with core, when turned out, to be drawn out sidewise. The coremaker will pack a little green sand between the core plate and projecting part of this core to support it while drying.



Making a Three-Way Cock.

The Value of Recommendations.

By W. H. Wakeman.

It may seem strange to some readers that such a question as is suggested by the above title should ever be raised, for the idea of questioning their value has never occurred to them, but in many other cases, engineers and others do not hesitate to say that what some of our Irish friends would call a "character" is not worth the paper that it is written on. It is very natural to conclude that a man who will make such a statement is unable to procure recommendations, and often this is true, but it is a rule that has many exceptions. Let us consider for a few minutes some of the causes which lead to such conclusions. A certain man, who was by courtesy called an engineer, held his place for a time, principally because the owners were not very particular about details so long as the wheels continued to revolve, but the time came when he could no longer be tolerated, so he was discharged and another hired to fill his place. However, when he applied for a recommendation, he was given one which said that he had run the engine and boiler, and was considered a good engineer. When such specimens can procure these papers, we do not wonder that others consider them of little value.

In another case an engineer was discharged for being drunk and leaving the plant to its fate while he caroused, and then slept off the effects of his potations, and yet the firm who would not allow him to stay around their premises were ever ready to recommend him to others as a good man. Now I do not believe that any man should be given a recommendation under such circumstances, but, nevertheless, do claim that the value of one after it is secured should not be rated by the circumstances under which it is given, provided it was obtained honestly, but rather by what it will do for a man when he has secured possession of it. A short time ago I read of a case where a young man, who had served about six months' time as apprentice to a chief engineer, applied to him for a recommendation to fill an important position, but he was refused, because the said chief engineer doubted his ability to hold the situation. The young man was much disappointed, and very naturally confided his trouble to another young man who was employed on the premises in an irresponsible position. This genius was equal to the occasion, for seizing a sheet of paper and a pen, he proceeded to write out a first-class recommendation for his friend, and signed his own name to it. This was presented in due form, and strange to relate, it secured the position for the apprentice. Now, to any one who is acquainted with all of the circumstances, this document appears in a very undignified light, but inasmuch as it did all that any recommendation that has ever been written could do, is it reasonable to claim that it was of no value? We think not. The document told the truth, and was signed by its author in good faith, so that if there was any fault to be laid at the door of any one connected with the transaction, it should be consigned to the parties who accepted the document in question without investigation. The fact that it answered every purpose is unanswerable proof of its value. The young man succeeded in performing the duties of his new situation to the satisfaction of his employers.

While looking over some old papers a few days ago, the writer found a letter which reads as follows: "I have known Mr. W. H. Wakeman for the past five years, and know him to be an intelligent, honest, and faithful man, and a competent engineer, and I cheerfully recommend him to the favorable consideration of any party requiring the services of such a man." It is signed by the senior partner of a firm who formerly manufactured engines and boilers, and it was written fifteen years ago. When I wished to capture a certain position this is a part of the ammunition used on that occasion, and as it brought about the desired result I have no cause for saying that it was without value, although while looking backward now I can perhaps see some weak points in myself that a more extended experience has strengthened. The fact that this firm would give a recommendation to almost any one who would ask for it, made such documents of less value than they otherwise would have been, but did not make them worthless. If I take this one and place it by the side of one of those secured at a later date, and which would be called much more pretentious, and thinking over the circumstances under which they were secured and used, and remember that each one fulfilled its mission, how can I put a lower value upon one than the other? It would not be right to do so.

Even some of those men who claim to esteem these papers so lightly, will not fail to put in evidence all of them that they possess when striving to get some good situation for which there are many seekers. Furthermore, if some unfortunate fellow cannot secure one or more of them, none are more ready to mention it to their discredit than they. This goes to show that even they have some lingering regard for the good opinion of others.

Nothing tends to bring these documents into disrepute so much as to have men to whom they are given fail to meet the expectations of those who write them. Whenever a man receives such a paper from a friend, it should be his aim to do his work in the best possible manner at all times, keep his reputation above reproach, and when he wishes to go elsewhere, to leave his employers in an honorable and courteous way. Failure to do this injures the cause of labor in every case, and I have been surprised at different times in the past, to note the ignorance or indifference of laboring men concerning this important consideration. He who while occupying some unimportant position adopts these principles for his guidance, has taken the first step towards some much more important place in life which brings more comforts and greater remuneration. I urge upon my friends and fellow-engineers the great importance of strict adherence to these rules, regardless of the treatment that we may receive from our employers, for if we have a clean record, we are sure to find some one who will appreciate our services either sooner or later, and the consciousness of having done what is right, especially if we have been so situated as to make it hard work to do so, is no small consideration.

The Use of Milling Machines.

At the meeting of the A. S. M. E., in Detroit, Mr. Henry B. Binsse contributed a discussion of one of the topical questions relating to milling machines. We referred to this discussion very briefly in our report of the meeting, but as our readers are particularly interested in milling machines we now give his remarks in full, as follows:

At times, milling-machine literature has been marked by extravagant claims which have tended to hinder, rather than to aid, the growth of this most useful machine, because people have been led by them to look for economical returns from it under conditions for which the tool was not suited. For example, I remember a very fine slabbing machine which had been bought by a large engine company under the impression that it would replace their planer; but, as their engines were very carefully built, in

small quantities, they soon discovered that their purchase was a mistake.

As an instance of these misleading statements, there was a paper read some years ago on the milling machine, which passed without criticism, and had a wide circulation, and which recommended the milling machine for jobbing-shop use where there is a great variety of work with little duplication, for shops like the engine works just mentioned. I have been unable to find an instance of the economical use of the milling machine under these circumstances; in fact, the experience is universal that the cost of the cutters, arbors, bushes, devices for holding the work, in addition to the extra time needed for setting the work (for it generally takes longer to set a single piece on the miller than it does on the planer); all these items make the milling machine a very expensive tool for general work, far more so, indeed, than the shaper or planer.

Defining, in general, the respective fields of usefulness of the two machines, the planer may be said to be a tool for facing plane surfaces of all kinds, while the milling machine may be called a tool for rapid and accurate duplication, using a revolving cutter. The two types do not compete, they work side by side. Whenever there is work enough of one kind to keep a planer busy, then is the time to consider giving that work to a milling machine.

A year or so ago, a comparison was made, in a paper read before the society, between the working times of a slabbing milling machine and a planer, greatly to the latter's disadvantage. The figures given were very remarkable, suggesting the well-known measured mile records of our cruisers. Accepting the correctness of the observed times, the comparison itself was unfair, because the milling machine in question was a tool especially adapted for cheap duplication of exactly that class of rough work. We might as well compare the time of cutting screws in a turret-screw machine with the time for similar work in the lathe. There is no mystery about the output of special tools. Designed for certain kinds of work only, they excel in that line, and are fit for nothing else. It is to be regretted that in that paper no figures were given of the cost of getting ready to do the work. This is a most important item usually. Last winter, having some large face cams to cut, I had an excellent opportunity to observe the cost of new milling operations. I kept a very accurate cost record, and while the actual time of cam cutting was 114 hours only, 80 hours were spent in making the cutters, arbors, bushes, collets, straps and so on for the job. Although the cost of milling cutters has been much reduced of late years, they are still expensive, the large ones especially so. Mr. H. L. Arnold says, in one of his recent excellent papers on milling practice, that the use of large cutters, although suggested by theory, is practically prohibited by their great cost. The record of the incidental work is as much a part of the cost of milling as the actual milling time. It is also characteristic of all work done by the milling cutter that the cost increases very rapidly with the size of the piece to be operated upon, so that it is out of all proportion more expensive to mill large than small work. In fact, at the present time, it seldom pays to mill large pieces. In addition to the greater cost of large milling there comes decreased accuracy, for accuracy of milling operations becomes more difficult to attain as the size of the piece increases. It is very costly to mill large work, and more expensive still if accuracy be desired.

Milling demands greater care in regard to the quality of the metal than planing. The piece of work must be soft, and, if possible, free from scale. We all know that we cannot avoid occasional hard castings, hard spots in castings, castings with the sand burnt into the skin, or castings with chilled faces. While accidents like these may ruffle the planerman's calm of mind, the milling boss is knocked down by them, for they may ruin a costly mill gang in a few minutes.

Where much milling is done it is usual to anneal and pickle all the castings and forgings; and I have known even the fine sand of excellent malleable iron castings to rapidly dull a set of milling cutters. A hard, bad casting may be planed at the cost of a little time and patience; but it is generally impracticable to mill hard iron. This is a trifling drawback for small work, but it would be of importance should we wish to use the milling machine for the same variety of work as the planer.

Thus at present, there is no reason to look for any gain from the use of the milling machine where there is little duplication, or for medium and large work, on account of conditions entirely independent of the design of the machine. Moreover, there is little to encourage the inventor who may wish to design a machine which will cover as great a range of different forms of work as the planer. The revolving cutter demands an amount of rigidity in the arbor and in the machine which in the planer is not at all essential. All of us have seen very accurate work by a skillful planer hand, when the tool deflection was visible to the naked eye at a distance. This is impossible in milling practice. It is on this account that while the ordinary commercial planer need not be, and indeed is not, a nicely fitted tool, the fitting of the milling machine cannot be too perfect. To the same cause, moreover, must we ascribe the simple forms of all existing successful types of milling machines. They are direct in design, not from a lack of inventive capacity, but because simplicity is a condition precedent to success. It must be apparent, then, that it is most difficult, perhaps impossible, to construct a practical milling machine which shall have the compound and swivel-tool movements of a planer crosshead.

Are these views supported by the past growth of the machine? After half a century of development we find an endless variety of milling machines, which have been designed especially for certain jobs. There are gear cutters, slabbing machines, plain and universal machines, duplex, triplex and quadruplex machines, keyseaters, vertical spindle machines, column millers, circular machines, profiling machines and so on, through an endless list; each year brings forth new designs. There are many styles, each one excellent for its special purpose. The output of these tools is almost beyond belief in many instances, and, without doubt, this is the promising field for the milling-machine designer.

In conclusion, I would call attention to what is to my mind a serious misstatement, and it is one heard very frequently, that the merits of the milling machine are not well understood. On the contrary, it seems to me that it is the most distinctly American of all the machine tools. Fifty years ago we were the first to recognize the paramount importance of this tool for interchangeable duplication, and to-day we find that every existing successful type of milling machine has been invented and developed in the United States. If we do not understand how and when to use the milling machine, where is this machine better understood? It has been my experience that the machine is bought just about as soon as there is any use for it, and sometimes sooner than is strictly economical.

There was a humorous case of this which comes up before me. I was visiting the perfectly equipped workshop of one of the best mechanics in the country, and I was very much impressed by a line of beautiful but expensive milling machines; but it was not clear to me that he could have much use for them, so I asked, "what work do you do with them?" In reply he said, "The planer is not in it with these machines." As this was no answer to my question I looked around, and I saw that at each planer there was a heap of castings, waiting to be finished, while the floor was perfectly clean around the millers, and a thin layer of dust showed how seldom they were used. The operation of milling is so pleasing to the eye that it sometimes misleads our judgment.

It is rare that there is any economy in milling in the first stages of the manufacture of a new machine. Milling-machine economy is a function of the duplication of the product.

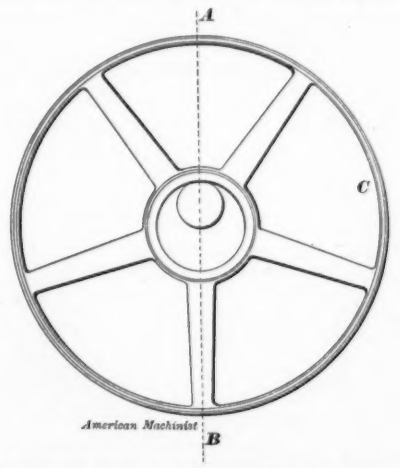
The Submerged Chain for Canal Traction.

While the subject of electrical traction upon the canals is under discussion, everything bearing upon the general subject of canal and river traction should be of interest. Attention is called to the recent disappearance, now almost complete, of sailing vessels upon the River Elbe, in Germany. The number of such vessels in 1870 was over 2,000, in 1889 there were but 215, and now they are so few that the government is doing away with the draw spans in the railroad bridges, thus stopping them entirely. A system of traction has been adopted there which it would seem should at least be tried upon our own canals. A heavy chain is laid in the bottom of the river and chain tugs overhaul this chain, towing loaded barges, as many as six at a time. The tug in use on the Elbe is, of course, a steam tug, but upon a canal it might easily be operated by an electric current taken from an overhead wire. The steam-operated tug, if the engines were properly designed, should show a high steam economy, and should be cheaper both to build and to operate than tugs driven by steam produced electric currents. If, however, the electricity costs nothing, which some imagine to be the price of it at Niagara, of course the steam could not hope to successfully compete with it.

Balancing Pulleys Upon Small Arbors.

"Techno," who writes in *Industry*, has "discovered" that pulleys may be balanced just as well by using an arbor much smaller than the base as by using one that fits, so that a lot of pulleys with holes of various sizes may be balanced upon a single arbor if it is only smaller than the smallest hole, and the expense of providing a lot of arbors is saved; also the labor of driving the arbors in and out. He says "the rolling action seemed to be even more sensitive when the mandrel did not fit the hole," and he argues that only the slavery of habit has maintained the custom of fitting mandrels for balancing pulleys.

The actual fact is that both theory and practice long ago demonstrated that pulleys cannot be balanced in the way discovered by "Techno" in a shop upon the Pacific coast. Take a pulley with a four-inch hole upon a two-inch mandrel. The pulley is, of course, freer to move, or "more sensitive," than if it were on a tight-fitting mandrel. It would be still more sensitive if suspended by a string, but its sensitivity might still give us little evidence of its state of equilibrium when held rigidly central. This pulley, bearing merely along a line upon the top of the small mandrel, is free to swing upon it as a pendulum swings, and any swing in either direction causes a preponderance of weight upon that side, and within certain limits this preponderance may not be sufficient to cause either the pulley or the mandrel to roll, and so can tell us nothing. Suppose the vertical line *A B* to be exactly central with reference to both the mandrel and the pulley. If the pulley is in perfect balance it will have no tendency to move either itself or the mandrel. If the pulley is not in balance, but is heavier, say, at the right-hand side *C*, then upon the removal of all restraint its tendency will be to swing a little to the left. It is evident that a very minute movement would occur in the case of a pulley that was not outrageously out of balance, because this movement transfers so large a part of the pulley from the one side to the other side of the central line. To allow the pulley to turn the mandrel must turn, but it will be found that the mandrel is by no means as sensitive with the unbalanced weight applied to it in this way as where that weight has the direct leverage of the pulley. As the pulley swings to the left the bearing upon the top of the mandrel is transferred slightly to the right, and where the two surfaces in contact were originally level they now incline downward toward the right, and when the mandrel does begin to turn the pulley rides down hill upon it. The mandrel, of course, revolves faster than the pulley and soon goes too far, so that when a movement does occur it is not a uniform movement of either pulley or mandrel, but an exasperating complication of swinging and dodging between the two. For a rough, cheap, hasty way of guessing at the balance of a pulley it is better to roll it along a planer platen or lathe shears than to try it upon a small mandrel. We have had experience of all three methods of balancing and know whereof we affirm.



Literary Notes.

AMERICAN STEAM VESSELS. By Samuel Ward Stanton.

In this book are given illustrations and brief descriptions of various types of successful American steam vessels in service at various times and localities; including ocean steamers of note, a number of naval vessels, sound, lake, and river steamboats, and steam yachts, making in all 280 steam vessels, each of which is illustrated by a full-page picture. These pictures are reproductions of pen drawings, not made to scale, the majority of which were exhibited at Chicago. The descriptions of the vessels will be of interest and value to the engineer, brief as they are; they give the dimensions of the hulls, type and size of engines and boilers, the builders' name, and the year in which the vessels were built. As far as we have been able to examine the data given, we believe it to be reliable. All the illustrations are arranged in chronological order, so that the book gives a pictorial history of the growth of American steamship building, and shows to some extent the style of naval architecture adapted to particular services in various localities. To furnish this information is the purpose of the book, for which it is well adapted.

The book contains 499 pages, 8x11¼ inches, and a good index. It is published by Smith & Stanton, 129 Broad street, New York. Price $5.

While we were remarking what a "drug on the market" molasses has become, we did not allude to the fact that machinery is mostly to blame for it. Molasses is not what it used to be. Centrifugal machines get the greater part of the sugar out of it, and little more than the color and smell are left, and it is a nuisance that inventors are implored to mitigate. It is reported that there are 25,000,000 gallons of it stored up that no man living knows what to do with. It cannot even be discharged into the streams, as it then becomes intolerable by its souring, and all hopes are now centered upon using it as fuel. Experiments upon a small scale have been successful, but no burner is yet in sight that will use it in a large way and without gumming up or otherwise failing in its work.

Messrs. White, Child & Beney, who are introducing American machinery and tools in Vienna, Austria, and are agents for Prentice Bros., Worcester, Mass., The Reeves Wood Split Pulley Co., and the Hart Mfg. Co., Cleveland, Ohio, write us that manufacturers in America are too apt in

many cases to think that Austria and Germany are the same countries, whereas they are quite different governments, and require the payment of different duties on imports, those in Austria being much higher than in Germany.

The American Association for the Advancement of Science will meet at Springfield, Mass., August 28th to September 7th.

The bugaboo of gold exports is still being "worked" for what it is worth by those interested in declining stock quotations.

Mr. W. L. Cheney, of Meriden, Conn., has been awarded by the Franklin Institute, the Longstreth silver medal for his double forming tool and holder used on the Meriden Machine Tool Co.'s forming lathes.

NEW CATALOGS.

There are three sizes of Standard Catalogs, 9" × 12", 6" × 9" and 4½" × 6". We recommend the 6" × 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

We have received from Foote, Barker & Co., Cleveland, Ohio, a pamphlet illustrating and describing their improved cutter and reamer grinder, adjustable two-spindle drill press, and their cock grinder. It is 5¼"x7".

P. Pryibil, 512 W. Forty-first street, New York, sends us a small pamphlet in which are illustrated various forms of hangers and boxes for line shafting, with full information, telegraph code, etc. It is sent on application, and is 3⅝"x6⅜".

Dietz, Schumacher & Co., Cincinnati, Ohio, have issued a pamphlet devoted to the illustration and description of their improved 14-inch lathe, which has some special features of interest to machinists. It is sent on application, and can be readily trimmed to standard size (6"x9"), as it is 6¼"x9⅛".

We have received the catalog of the Swarts Metal Refining Co., 120 W. Lake street, Chicago, Ill. This catalog sets forth the qualities of various brands of babbitt metal and other alloys useful to machinery builders and others. It is bound in cloth, and is standard size 6"x9".

We have received the catalog of the American Institute of Mining Engineers, which contains a full list of members, and is arranged in much the same style as the catalog of the A. S. M. E. We suppose this catalog was intended to be standard size, as it should be; it measures 5⅞"x9¼".

Morris Machine Works, Baldwinsville, N. Y., send us descriptive circular and price list of centrifugal pumping machinery, built under the Heald & Sisco patents. These pumps are specially adapted for paper, pulp and sulphite fiber mills, tanneries, etc., and are fully described in the pamphlet which is sent on application. It is 6"x9⅛".

Philadelphia Engineering Works, Philadelphia, Pa., send us "catalog N," which is devoted to the illustration and description of condensing and non-condensing engines applied to rolling-mills. Engravings of typical engines for this service are given, with indicator cards from them and other general information of interest to mill users. Catalog is standard size, 6"x9".

The Philadelphia Engineering Works, Philadelphia, Pa., send us "catalog M," which contains rules and tables for the equalization of power developed in the cylinders of compound engines. The title of this catalog sufficiently indicates its character, and it will, of course, be found useful and convenient by those who have to do with steam. It is standard size, 6"x9".

J. T. Slocomb & Co., 227 Eddy street, Providence, R. I., send us a catalog of machinists' tools, in which are illustrations of their inside micrometer calipers, micrometer depth gages, indicators for lathe work, combination center drills, micrometer calipers, etc. It is sent on application to those interested, and is standard size, 6"x9", with the fact that it is standard printed on the cover.

We have received from D. Van Nostrand Co., 23-27 Warren street, New York, a catalog of books relating to steam and steam engines, machinery, mechanics, and mechanical engineering. As indicated by its title, this catalog will, of course, be interesting to all who have to do with machinery of any kind, and it is sent to any address on application. It is 5⅞"x9¼", and could as well have been trimmed to standard size—6x9.

The White Mfg. Co., 40-42 State street, Chicago, Ill., send us an illustrated price list of gasolene torches, furnaces, and paint burners. These are in various forms, designed to produce a blast by air pressure, a pump being attached, and many of them are intended especially for machinists and tool makers, electrical workers, etc., and are highly efficient for heating, tempering, brazing, and other operations. It is 5⅞"x9¼", and could as well have been standard size—6"x9".

The Philadelphia Engineering Works, Philadelphia, Pa., send us "catalog L," which is devoted exclusively to the illustration and description of their improved fly wheels for engines. The catalog contains useful information regarding fly wheels in general, and includes also an engraving of the machine used by this concern in turning fly wheel faces. The wheels are made from 8 to 35 feet diameter, and with any width of face up to 78 inches. The catalog is standard size, 6"x9".

Hans Renold, of Manchester, England, sends us what he calls "Sectional Catalog No. 5," which is devoted to the illustration and description of steel balancing chains manufactured by him. These are intended to be applied especially to counterbalancing the parts of machine tools and other machines, and are sometimes used as a convenient means of affecting feed motion. The chains are made in various styles to suit conditions, and where desired are finely finished and blued, so that they contribute to the appearance of the machine for which they are used. The catalog is standard size, 6"x9", and a statement that it is standard size is printed on the back cover.

We have received a catalog giving a full account of the growth of the Gustav Fritzsche Bookbindery, and also giving a description of its present extensive and commodious building, located in Leipzig, Germany. This large establishment is now managed by the sons of the founder, who are the bookbinders to the Court of Saxony. The exterior of the building, as shown in the catalog, is very handsome and artistic in design. The interior views show that all departments are well equipped with machinery of the latest design, and, taken all together, show the building to be a regular bee-hive of industry. The catalog is very neatly gotten up, and the illustrations show that photography and its reproduction by the half-tone process have become a high art in Germany. The catalog is 5⅛x8⅛".

MANUFACTURES

The Premier Bicycle Co., of Bridgeport, Conn., has been organized with a capital of $125,000.

The Great Western File Co. has been organized at Beaver Falls, Pa., with a capital of $400,000.

Lane's Foundry and Machine Works, Huntingdon, Pa., are enlarging their plant, and will shortly manufacture bicycles.

The Great Falls Manufacturing Co., of Somersworth, N. H., will increase the salaries of their 2,000 employes 8 per cent.

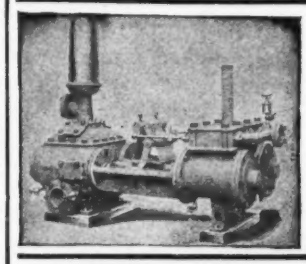
The American Pump Co., of Chicago, Ill., has been incorporated with a capital of $45,000, by C. C. Hill and R. F. Cummins.

McDowell, Stocker & Co., of Chicago, are sole agents in that territory for the sale of the Springfield Machine Tool Co.'s products.

The Bald Mountain Mining Co., of Denver, Col., has been incorporated by Fred E. Miller and Chas. F. Miller, with a capital of $30,000.

The Edgefield Mfg. Co., of Edgefield, S. C., has been formed with $100,000 capital, by D. A. Tompkins and B. M. Miller.

Geo. S. Graham and Henry G. Goodrich have organized the Marsden American Cellulose Co., at Philadelphia, Pa., with a capital of $1,000,000.



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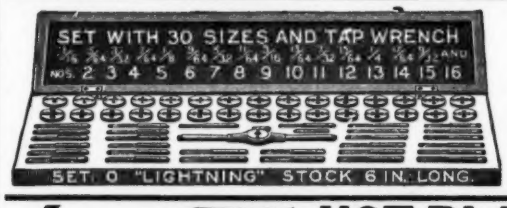

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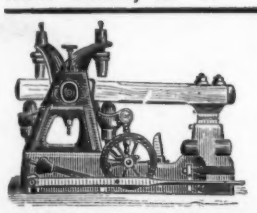

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The National Tin-plate Co., of Anderson, Ind., will put in a bar-mill in connection with their tin-plate establishment.

The Philadelphia Metallic Manufacturing Co., of Coopersburg, Pa., has been organized by H. N. Booz and C. H. Stoneback, with a capital of $50,000.

The Clark Telephone and Construction Co., of Minneapolis, Minn., has been incorporated with $200 000 capital stock, by Marion A. Clark and A. S. Samson.

The Morris Machine Works, Baldwinsville, N. Y., announce that they have established a New York office at 39-41 Cortlandt street, which will be under the management of Hungerford Bros. & Co.

The iron foundry of the Knowles Steam Pump Works was burned last week. The loss is estimated at about $175,000, and was fully covered by insurance.

What is said to be the largest belt in the world has recently been made by the Jewell Belting Co., of Hartford, Conn., for the Washburn & Moen Mfg. Co., of Worcester. It is 118 feet long, 78 inches wide, and is four-ply. It took the hides of 100 steers to make it.

The Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, report a steady increase in foreign and local trade, and anticipate a large fall business. They have recently made shipments to South Africa, Brazil, Russia, and England. They also have orders on their books from France, Germany, and Mexico.

A contract has been awarded to a Philadelphia firm to build a double track standard gage road between Washington, D. C., and Baltimore, Md., to be used for trolley express trains. Messrs. Widener and Elkins, who are interested in the project, expect to have the road completed within a year to enter into active competition with the steam roads. The estimated cost of the construction is $3,000,000.

The Weir Plow Co., of Monmouth, Ill., have decided to build a new factory at East Moline, Ill., having secured a tract of 17 acres at that place. They will build a one-story brick plant to employ 500 men, and will manufacture plows, cultivators, disk harrows, and corn planters. Work on the new factory will commence this fall, with the expectation of starting about October 1, 1896.

The Composite Type Bar Co. has been organized in New York City, to manufacture type-making and type-setting machinery. Capital, $25,000. Directors: Caleb H. Jackson and Caleb S. Jackson, of New York City; Lucien A. Brott, George A. Kay, and Marcus Marx, of Brooklyn. Mr. Brott, who until recently was in charge of the tool room of the Merganthaler Company, is the inventor of the machine.

Messrs. J. T. Slocomb & Co., Providence, R. I., are putting up their improved micrometer calipers, which have been illustrated in our columns, in a very neat case in such a manner as to protect them and keep them always in good condition and convenient for use. The case holds a half dozen of these calipers, designed to cover a range of measurements from zero to 6 inches, each tool having a movement of its micrometer screw of 1 inch.

The Jones & Lamson Machine Co., of Springfield, Vt., has recently made the following shipments of their flat turret lathes: Shaw, Kendall & Co., Toledo, Ohio; Maltzowschen Works, Djatkowo (Orel), Russia; Hancock Inspirator Co., Boston, Mass.; Indian Orchard Screw Co., Indian Orchard, Mass.; Passaic Machine Co., Passaic, N. J.; McIntosh, Seymour & Co., Auburn, N. Y.; Henry R. Worthington, Brooklyn, N. Y.; Klein, Schamslin & Becker, Franhuethal, Germany; Providence Machine Co., Providence, R. I.; Vermont Farm Machine Co., Bellows Falls, Vt.; Port Chester Bolt & Nut Co., Port Chester, N. Y.; Dean Bros. Steam Pump Works, Indianapolis, Ind. They are also supplying the New Haven Chair Co., New Haven, Conn., with their equipment of turret machinery for the manufacture of hubs, sprocket wheels, cones, cups, etc., for bicycles.

The Abendroth & Root Mfg. Co., 28 Cliff street, New York, have recently contracted for a plant of boilers to go in what is said to be the largest tobacco factory in this country. The factory is being built at St. Louis, by Liggett & Meyers, and the boilers will aggregate 21,000 horse-power, being arranged in three groups of 7,000 horse-power each. The boiler plant, it is said, will, besides being uncommonly large, be a model in the way of arrangement, and will be provided with every approved device for economical steam making. Mississippi water will be used in this plant, and as the peculiarity of this water largely depends upon which of the Mississippi tributaries may happen at a given time to be high or low, arrangements have been made for first filtering the water by two different systems to remove the mechanically suspended matter, and after that the water is to be run through Hoppes' live steam purifiers to remove the sulphate of lime and other scale producing impurities which are not removed by the fitters.

The new mill of the Berkshire Manufacturing Co., at Adams, Mass., designed by Mr. F. P. Sheldon, of Providence, will have features entirely new in this country. The departure is in the use of steel floor beams. It is stated that the cost of the metal will not be greater than that of yellow pine, and that the increased stiffness of the floor will enable the fine goods machinery to be run to better advantage. Increased width of mills, larger windows and wider bays—the space from beam to beam—have weakened the floors and made them more subject to vibration. It has been supposed that the price of steel was prohibitive, but this objection was overcome by placing longitudinal girders on the steel girders, thus reducing the spans to very short spaces and greatly enhancing the rigidity of the flooring. Unlike the large wooden beams, the steel beams do not weaken the walls. Pine beams, with the air space, take 16 inches out of a 32-inch pier, while the steel I-beam, imbedded in the bricks, becomes a part of the structure. The new mill will be known as No. 3 mill, and will be 440 feet long, 118½ feet wide and five stories high. The five-story ell will be 163 by 50 feet, and in the rear will be a cotton house. The equipment will consist of 80,000 spindles and 2,100 looms, and 1,000 operatives will be employed. The three mills will have 155,000 spindles and 3,600 looms. The plant will be one of the largest in New England, there being few having more than 150,000 spindles and a fine goods mill. No. 3 mill is said to be the largest of its class in the country. There will be a twin tandem engine of 1,600 horse-power, with a fly wheel 22 feet in diameter and a face of 11½ feet turned for four belts. Either side of the engine will drive the machinery. The boiler plant will be in the yard of No. 1 mill, and steam will be carried across the street a distance of 280 feet. All the Providence engine builders are preparing bids for the motive power. A brook will be carried under the mill in a 6½-foot iron feeder to the condensers of the engines, and a branch pipe will supply condensing water to No. 1 mill. Each of the two floors for looms will be free from belts, all the belting being from below. All the preparation machinery, except the pickers and the mules, will be furnished by Hetherington, England, who was the lowest bidder; the ring spinning will be from Fales & Jenks, Pawtucket; the looms will be built at the Mason Works, Taunton, and Draper spoolers and warpers have been ordered. It has been stated that the mill will cost $1,000,000, but the expenditure, the *Journal* is informed, will not exceed $775,000. — *Providence Journal.*

Machinists' Supplies and Iron.

NEW YORK, August 17, 1895.

Iron—American Pig—We quote standard Northern brands, $14 for No. 1; $13 for No. 2; $12.75 for No. 2 Plain, and $12.50 for Gray Forge. Southern brands, $13.50 to $14 for No. 1; $13 to $13.25 for No. 2; $12.50 to $12.75 for No. 3; $13 to $13.25 for No. 1 soft; $12.75 to $13 for No. 2 soft; and Foundry No. 4, $12.25 to $12.50

Antimony—The market is moderately active and prices are barely steady. We quote L. X., 8¼c. to 8¾c.; Cookson's, 8¼c. to 8½c; Hallett's, 7.15c. to 7.20c.; U. S. French Star, 7.35c.; Japanese, 6.85c. to 7c.

Lard Oil—Prime City we quote at 50c. to 51c.

Copper—Large sales of Lake Superior Ingot are reported at 12c. for early delivery, prices later ranging as high as 12¼c. Electrolytic, 11¾c. to 11⅞c. Casting has advanced sharply and is not easily obtained. Quotations range from 11½c. to 11¾c.

Lead—In Lead we note little change. Prices are kept up to 3.55c. for round lots, and 3.57½c. to 3.60c. for car loads.

Spelter—We note a further rise. 4.15c. to 4.17½c. was paid for ordinary Western, and it is doubtful if purchases could be effected below 4.20c.

Tin—Prices are slightly lower, although considerable business has been done. 14.15c. is now quoted.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS.

On and after July 4th this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Bright, active machinists to canvass for subscription to AMERICAN MACHINIST, liberal commission. Address, with refs., Subscription Dep't, AMERICAN MACHINIST, 203 Broadway, N. Y.

First-class, reliable engineer and draftsman wants to change pos'n. X, BOX 85, AM. MACHINIST.

Wanted—Situation as general foreman or superintendent of high speed engine shop; at present supt. of shop. "D. A.," care AM. MACHINIST.

Practical machine man with some money to take charge of foundry and machine works. Address D., care AMERICAN MACHINIST.

Mechanical draftsman with technical education, shop and office experience, wants position. Address BOX 68, AMERICAN MACHINIST.

Foreman Blacksmith Wanted—Man familiar with engine and ship work. Apply by letter, stating experience and age, to The Atlantic Works, East Boston, Mass.

Wanted—Six first-class toolmakers, steady work; none but first-class workmen need apply. Eclipse Bicycle Co., Elmira, N. Y.

Experienced Designer Wanted—Familiar with all classes of bookbinders' and paper-cutting machinery, for the West. Address, stating all particulars, "A," care of AMERICAN MACHINIST.

First-class millwright, good draftsman, foreman in leading millwright and machine shop, wishes to make a change; A1 references. Address Mill, 177 E. 73d Street.

Wanted—Foremanship of machine shop, eight years' experience as foreman. Able, energetic. Age, thirty-three. Good references. New York State preferred. Address Box 82, care AM. MACH.

Wanted—An instructor in the mechanical engineering department at University of Illinois, to teach elements of machine design. Address, with references, L. P. Breckenridge, Urbana, Ill.

Wanted—A position as foreman or leading workman in some good jobbing shop, by an intelligent, first-class mechanic; can make good shop sketches, etc.; age, 32; south or west of Ohio preferred. W. W., AMERICAN MACHINIST.

Wanted—Experienced foreman patternmaker (A1), capable to take charge of from 15 to 20 men; give age, experience, salary expected, and place of present employment; all communications confidential. Address Large Work, AM. MACHINIST.

Wanted—A first-class toolmaker for a small bicycle factory in Central Pennsylvania; must be a first-class man in every respect; permanent place for the right man. Address C., care AMERICAN MACHINIST.

Position wanted as foreman master mechanic, or any capacity requiring the services of a first-class mechanic; experienced in marine and stationary engine building and rolling-mill work, and very good draftsman. BOX 64, AMERICAN MACHINIST.

(*Continued on Page 674.*)

POWER OR HAND PLANER,

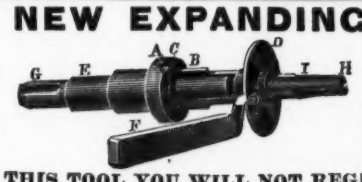
FOR MODEL MAKERS, EXPERIMENTAL WORK, &c.

Has all the Improved Features Usually Found on High Grade Planers, and is Capable of Doing the Best and Finest Work.

MANUFACTURED BY
A. J. WILKINSON & CO.,
184 Washington Street, Boston, Mass.

LECOUNT'S NEW EXPANDING MANDREL.

Amateur's Size.
Taking anything from ⅛ to 1 inch inclusive.
Price.....$5.00
Patented Dec. 25, 1877.



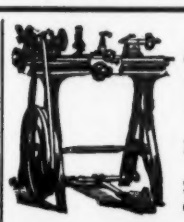
Machinist's Size.

No.				PRICE.
1	⅛ to 1	in.		$10
2	1	"	1½ "	14
3	1½	"	2 "	18
4 (with screws)	2	"	3 "	33
5	3	"	4 "	44

IF YOU WILL TRY THIS TOOL YOU WILL NOT REGRET THE EXPENSE.
C. W. LECOUNT, SOUTH NORWALK, CONN.
SPECIAL MANDRELS FOR SPECIAL JOBS MADE TO ORDER.
These goods are for sale by CHAS. CHURCHILL & CO., L'td. 21 Cross St., London, England.

Agency Wanted.

A representative of **Agricultural Machines,** Mowing Machines, and Hay Tedders, would like to enter into connection with American firms. Only of American manufacture considered.
Please send answers in German to B. 1477 Lz., to
HAASENSTEIN & VOGLER,
LUZERN, SWITZERLAND.



Star Lathes
Foot-power Screw Cutting
Automatic Cross Feed
9 and 12 inch Swing.
New Designs. Novel Features.
Send for Catalogue B.
SENECA FALLS MFG. COMPANY
687 Water St., Seneca Falls, N. Y.

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INSIST ON HAVING
NICHOLSON

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3000
VARIETIES FILES
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Special Machinery.
FITCHBURG
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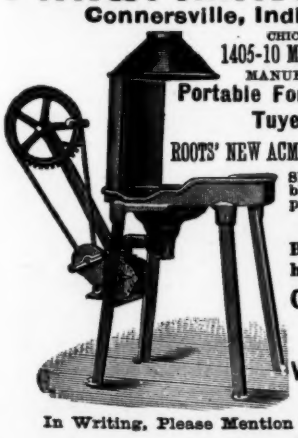
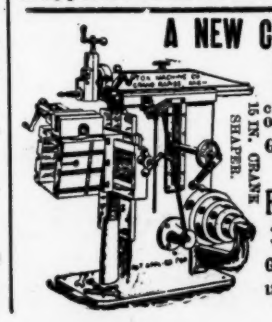
MANUFACTURERS OF
Portable Forges,
Tuyere Irons, Etc.
ROOTS' NEW ACME HAND BLOWERS,
Slow speeded, Force blast, Durable, Compact and Cheap.
Roots' Foundry Blowers, Gas Exhausters, Etc.
COOKE & CO.
Selling Agents,
163 and 165 Washington St., NEW YORK.



In Writing, Please Mention This Paper.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 Walnut St., Philadelphia.
Our New and Revised Catalogue of Practical and Scientific Books, 88 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

A NEW CRANK SHAPER.
NOVEL, YET SIMPLE.
Length of stroke changed INSTANTANEOUSLY while IN MOTION.
Get Photos & Prices.
NOTHING LIKE IT.
Fox Machine Co.,
325 Nor. Front St.,
Grand Rapids, Mich.
135 Finsbury Pavement, London, England.



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FOR TOOLS, DRILLS, DIES, &c.
ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
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WM. JESSOP & SONS, LTD.
Established a century ago.
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FOR EXPENSIVE TOOLS
Bohler Bros. Styrian Tool Steels
Will be found to be the cheapest and best if wearing qualities are considered.
HOUGHTON & RICHARDS,
SOLE AMERICAN AGENTS,
148 & 150 Oliver St., BOSTON.

WORTHINGTON STEAM PUMPS
FOR ALL DUTIES.

HENRY R. WORTHINGTON,
NEW YORK, 86 and 88 Liberty St. BOSTON, 70 Kilby St. PHILADELPHIA, 607 Arch St. CLEVELAND, 24 South Water St. CHICAGO, 185 to 189 Van Buren St. ST. LOUIS, Eighth and St. Charles Sts. INDIANAPOLIS, 64 South Pennsylvania St. DETROIT, 155 Jefferson Ave

Wanted—Position as foreman or superintendent, used to designing tools for close interchangeable work to reduce cost; have had charge of light and heavy work; had experience building dynamos. Address A. T., American Machinist.

Wanted—Any firm wanting an engineer who can establish discipline and systematic methods producing lowest cost and best workmanship, as superintendent or manager can find a man with highest references and a record by addressing Experience, care American Machinist.

Wanted—Foundry foreman in a good Western city; must be accustomed to light work; acquainted with the latest and best foundry methods, also understand mixing and melting brass, and a man of good executive ability. Good steady job, state nationality, age and experience; give reference, and state salary expected. Address "Q." American Machinist.

Wanted—A young man to take charge of our engine department; must have a thorough knowledge of automatic high-speed engines, competent to execute high-grade work and handle 75 to 100 men, so as to turn out work at lowest cost of production; best of tools and equipments furnished; excellent opportunity for a live, active young man; state fully, age, experience, references and salary wanted. Address Buffalo Forge Co., Buffalo, N. Y.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—A first-class key-seater, new. Address Mitts & Merrill, 913 Tilden St., Saginaw, Mich.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

Wanted—A purchaser for a good key-seater, by Mitts & Merrill, 913 Tilden Street, Saginaw, Mich.

Pat's obt'd; no atty's fee until allowed; exp't service. Thurman & Silvius, mech. engs., Ind'polis, Ind.

For sale—Fourteen of Palmer's gear cutting attachment, at $10 each. J. & G. Rich, 120 N. Sixth street, Philadelphia.

Wanted—Complete volumes for the years 1881, 1883, 1884, 1885, bound or unbound. Address, stating price, American Machinist.

Wanted—To correspond with any one in need of a first-class key-seater, Address Mitts & Merrill, No. 913 Tilden Street, Saginaw, Mich.

For sale—Two 22" Plain Hamilton Drill Presses, one 26" back gear and power-feed Hamilton Drill Press one 30" Springfield Tool Grinder. These are new machines and will be sold cheap for cash. Dietz, Schumacher & Co., Cincinnati, Ohio.

Wanted—Patented or special articles to maket of aluminum, brass or iron; facilities unexcelled; exceptionally low prices quoted on experimental or jobbing machine work; write for prices. Rob't H. Casson, works, 198 Liberty St., Paterson, N. J.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offer.

Big investment—$25,000 cash will buy my well-established foundry, machine shop and mill supply store; pays 20 per cent.; with better management will pay more; bad health and other business is why I sell. Address Harry Guenther, 207 Crittenden St., Owensboro, Ky.

Established in 1874.

CLEVELAND TWIST DRILL CO.

COR. LAKE & KIRTLAND STS. CLEVELAND, O.

99 Reade Street, New York.
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REPAIR BICYCLES FOR A LIVING.

Easy way to make good living. Catalogue for 6 cents in stamps. FULL OUTFIT. Bellows, Blowpipe, Vise, Spoke Threader, Solder, Borax, ready to go to work. FRASSE CO., 17 Warren St., NEW YORK.

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ENGINE LATHES.

13 in. x 6 ft Blaisdell.
14 " x 6 " Flather.
15 " x 8 " Standard.
16 " x 6 " Blaisdell.
16 " x 7 " Pratt & Whitney.
16 " x 8 " Putnam, Al.
16 " x 8 " Fitchburg.
18 " x 8 " Flather.
20 " x 10 " Putnam, Al.
20 " x 10 " Harrington.
24 " x 12 " New Haven.
24 " x 22 " Perkins
28 " x 16 " Fay & Scott.
32 " x 16 " Waterman.
32 " x 30 " Improved style.
50 " x 16 " Triple Geared.

DRILLS.

Barnes Friction Drill.
Sensitive Drill, Improved.
Prentice 26 in. complete with Friction Pulleys for tapping.
Blaisdell 28 in. Bk. Geared.
Improved 28 in. complete.
Radials 3, 4 and 5 ft.

CYLINDER BORING MACHINE.

"Bement's" for Cylinders to 36 in.

PLANERS.

22 in. x 5 ft. Putnam.
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48 " x 10 " Gray, 2 Heads, Al.

SHAPERS.

10 in. Stroke, Crank, Prentiss.
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P. & W. No. 2 Wire Feed.
Brown & Sharpe No. 5, complete.

MILLING MACHINES.

Garvin No. 3 Power Feed.
Lincoln Pattern with Vise.
"Universal" Latest, good as new.
P. & W. No. 2 Hand Feed, Al.

BOILER ROLLS.

10 ft. Latest Improved.
8 " Extra Heavy.
7½ " Standard Size.

Gray Planers "NEW," 22, 24, 30 and 36 in.
Kempsmith Millers, Universal and Plain.
Bardons & Oliver's Screw Machines, Improved Style.
Fitchburg Lathes, 14 to 72 in. Swing.

J. J. McCABE,

SUCCESSOR TO E. P. BULLARD'S N. Y. Mach'y Warerooms.

14 Dey St., NEW YORK.

Second-Hand Machinery.

LATHES.

2 10 in. x 5 ft. Foot & Power.
2 11 in. x 5 ft. Power only.
1 15 in. x 6 ft. Dustin.
1 16 in. x 8 ft. Flather.
2 18 in. x 8 ft. Flather & Prentice.
3 18 in. x 8 ft. Lodge & Davis.
2 21 in. x 10 ft. Pratt & Whitney.
1 27 in. x 10 ft Dustin.
1 28 in. x 12 ft. Blaisdell.
2 30 in. x 14 ft. Lincoln.
1 32 in. x 13 ft. Bement Triple Geared.
1 22 in. x 10 ft. Niles.
1 24 in. x 10 ft. Niles.
1 79 in. Driving Wheel, Bement.
1 48 in. x 18 ft. Gay & Silver.

PLANERS.

3 48 in. x 32 in. x 6 ft. Pond, two heads.
1 48 in. x 32 in. x 8 ft. Pond, two heads.
3 24 in. x 24 in. x 6 ft. W & L., one head.
1 28 in. x 28 in. x 8 ft., Gay & Silver.
1 32 in. x 32 in. x 10 ft. W. & L.
1 38 in. x 38 in. x 10 ft. Aldrich.
1 32 in. x 10 ft. Open Side.
1 60 in. x 60 in. x 22 ft. Hepworth.

DRILLS.

3 22 in. Back Geared.
2 25 in. " & P. F., Snyder.
1 34 in " " Harris.
2 No. 1½ Niles Radial.
2 Suspension Drills.

MILLING MACHINES.

1 No. 1 B. & Sharpe.
2 No. 13 Garvin.
1 No. 15 "
1 No. 2 " Hand, and others.

SHAPERS.

9 in., 12 in., 13 in., 15 in., 20 in.

MISCELLANEOUS.

1 18 in. P. & W. Screw Machine.
1 20 in x 6 ft. Flather "
2 Horiz. B. & D. Machines.
1 Cylinder Borer. P. & A.
1 30 in. Motor Gear Lathe
1 Double Punch and Shear.
1 30 in. Pulley Lathe.
1 Hydraulic Riveter.
2 Bolt Cutters.
1 Nut Tapper.
1 20 in. Pattern Lathe.

Also large stock of other tools. Send for List.

Eastern Branch Niles Tool Works Co.,

136 and 138 Liberty St., NEW YORK CITY.

E. W. BLISS CO.

1 ADAMS ST., BROOKLYN, N. Y.
Chicago Office, 96 W. Washington Street.

FOOT AND POWER MACHINERY FOR WORKING SHEET METAL.

FORGING PRESSES, PUNCHES, SHEARS AND SPECIAL MACHINERY.

A NEW FRICTION CLUTCH.

STILES & PARKER PRESS CO.

SECOND-HAND MACHINE TOOLS.

ENGINE LATHES.

12 in. x 5 ft. Ballou Patent.
16 in. x 6 ft Ames Mfg. Co.
16 in. x 8 ft. Perkins, Taper.
18 in. x 10 ft. Blaisdell.
28 in. x 20 ft. Perkins.
37 in. x 14 ft. Maker Unknown.

PLANERS.

12 in. x 30 in. Wilkinson for Hand or Power.
22 in. x 22 in. x 4 ft. L. W. Pond.
24 in. x 24 in. x 5 ft. Putnam.
24 in. x 24 in. x 6 ft. Chamberlin.
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SHAPERS.

10 in. Pratt & Whitney.
12 in. Juengst, Crank.
15 in. Juengst Friction.
10 in. Wood and Light Traverse Head.
21 in. Smith & Silk, Shifting Belt.
20 in. Gould & Eberhardt.
24 in. Hendey, Friction.

HAND LATHES.

2 10 in. x 41 in. Garvin.
1 12 in. x 4 ft. L. W. Pond.
1 12 in. x 6 ft. Wright.
1 12 in x 5 ft. Back Geared.
1 20 in. x 8 ft. Back Geared.

MISCELLANEOUS TOOLS.

24 in Barnes Water Tool Grinder.
Garvin Profiler, one spindle.
No. 2 National Bolt Cutter.
60 in. Lincoln Gear Cutter.
26 in. Pulley Lathe.
50 in. Pulley Lathe.
5 in. Cutting-off Machine.
No. 2 Springfield Tool Grinder.
No. 1 Garvin Screw Machine.
No. 1 Brown & Sharpe Screw Machine.
No. 2 Brown & S. Universal Grinder.
21 in. Squaring Shear.
14 ft. Power Draw Bench.
250 lb. Gould & E. Drop Press.
100 lb. Stiles Power Drop Press.
75 lb. Drop Press.
No. 31 Eaton Double-acting Press.
No. 2 Garvin Wire Spring Coiler.

Also, a large number of other machines. Write for complete list, description and prices.

THE GARVIN MACHINE CO.,

LAIGHT & CANAL STS., NEW YORK.
Also, 51 North 7th St., Philadelphia, Pa.

SECOND-HAND MACHINERY.

Gould & Eberhardt Automatic Gear Cutter.
Pratt & Whitney 26" Chucking Lathe.
18"x5' Pratt & Whitney Lathe, taper attachment.
Niles Horizontal Boring Machine, 4" bar.
Betts Horizontal Boring Machine, 3' bar.
60" Triple Geared Engine Lathe, 1894 Pattern, used Three Months, a modern tool in fine order.

Will sell the above tools at low prices. Send for new catalogue of Bicycle Machinery.

PRENTISS TOOL & SUPPLY CO.,
62 & 64 So. Canal St., CHICAGO, ILL.

MACHINERY BARGAINS

BEFORE REMOVAL

At Phœnix Iron Works, Trenton, N. J.

15 in. x 6 ft. Engine Lathe.
22 " 12 " " "
29 " 13¼ " " "
26 " 20 " " "
29 " 12 " " "
37 " 30 " " "
71 " 18 " " "
52 in. x 20 ft. Engine Lathe.
19-36 and 50 in. Drills.
Portable Drill.
36 in. x 14 ft. Planer.
12 in. Shaper Traverse Head.
Gear Cutter, 54 in.
Milling Machine.

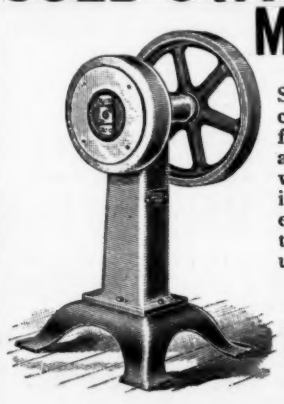
10 ft.-16 ft. Vertical Boring and Turning Mill, Cranes, Blower, Boiler Rolls, Punch and Shear, etc.

Send for full list and prices.

GEORGE PLACE MACHINE CO.

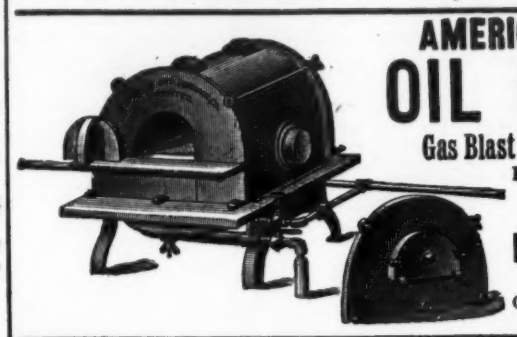
145 Broadway and 86 Liberty St.,
NEW YORK.

COLD SWAGING MACHINE



The Dayton Swaging Machine is the best for reducing and pointing wire and tubing. If interested address the manufacturers,

EXCELSIOR NEEDLE CO.
Torrington, Conn.



AMERICAN GAS FURNACE CO.,

OIL GAS PLANTS

Gas Blast Furnaces & High Pressure Blowers

For the economical generation and systematic application of HEAT.

CATALOGUES ON APPLICATION.

No. 80 Nassau St., - NEW YORK.

English Agency:
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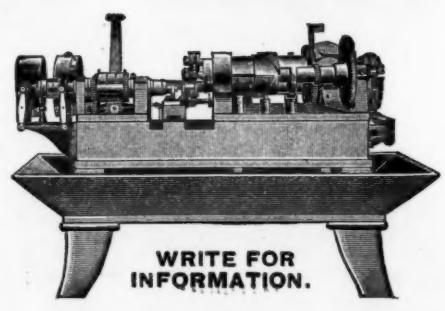

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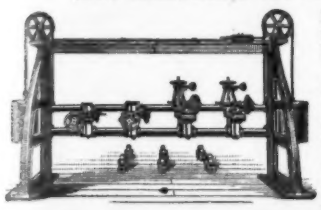

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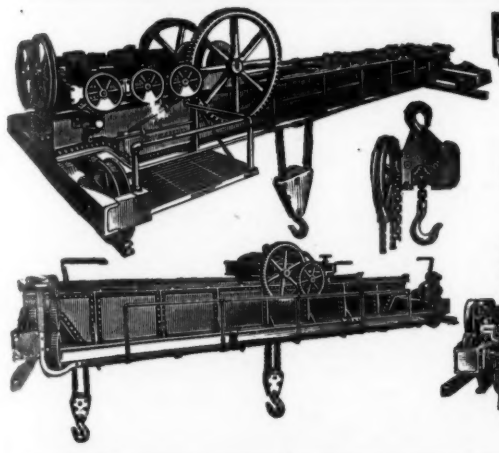

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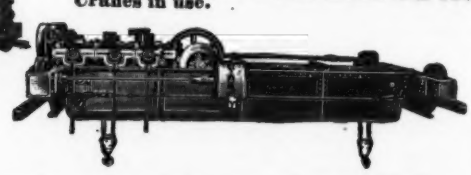

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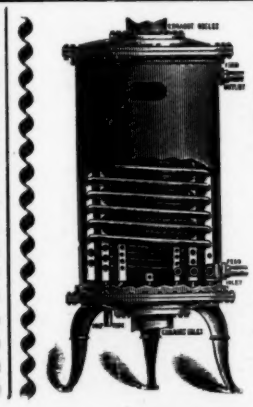

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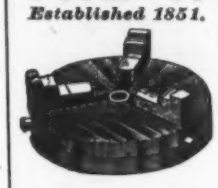

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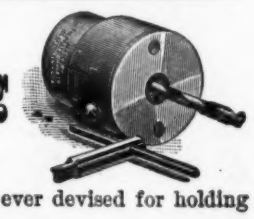

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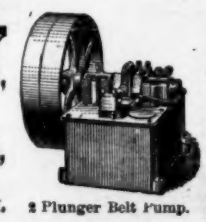

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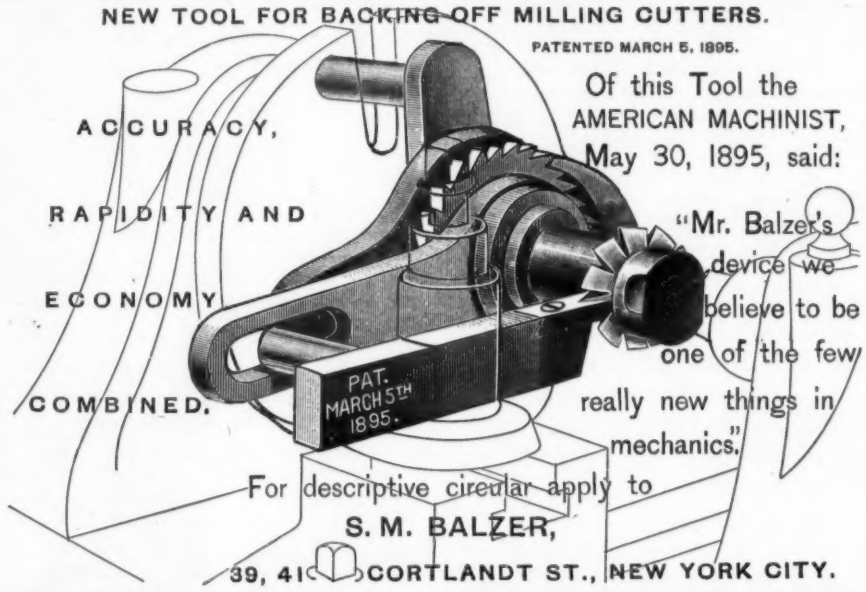

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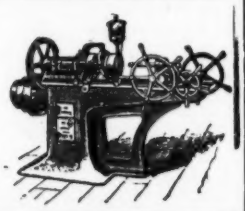

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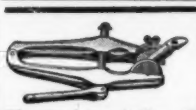

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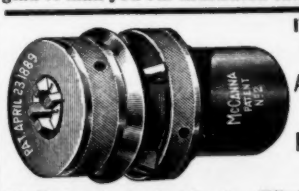

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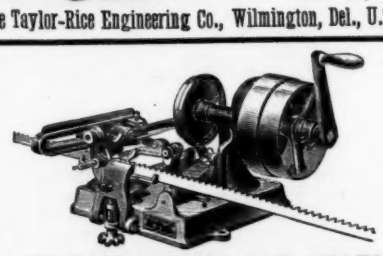

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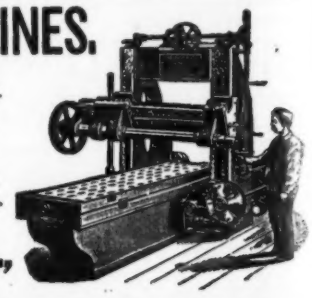

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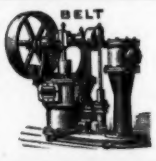

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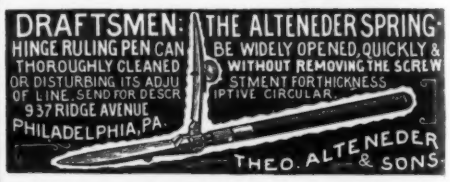
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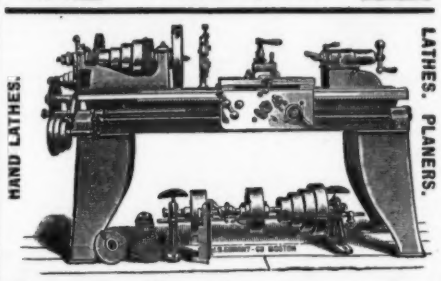

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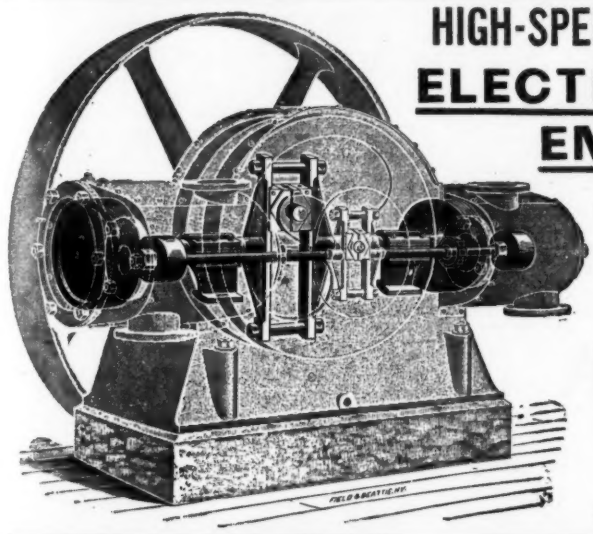

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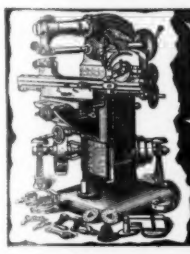

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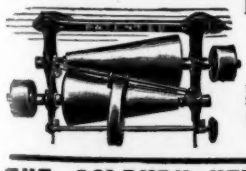

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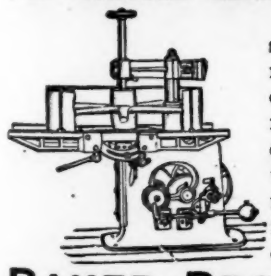

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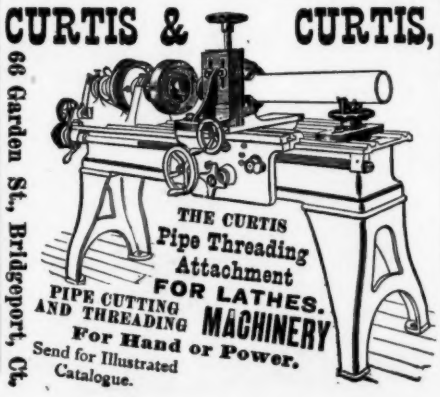

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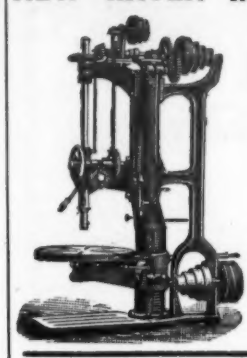

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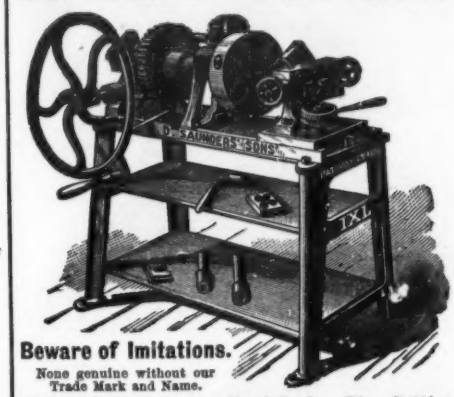

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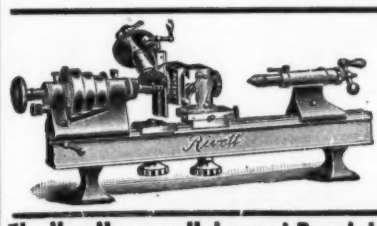

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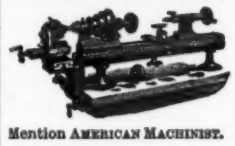

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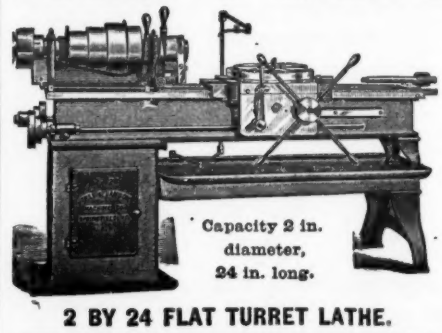

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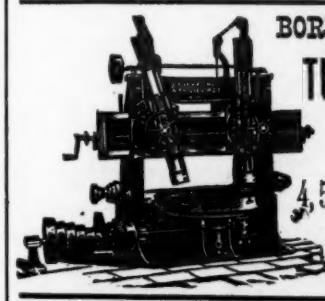

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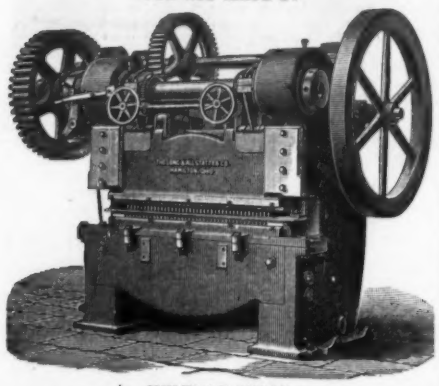

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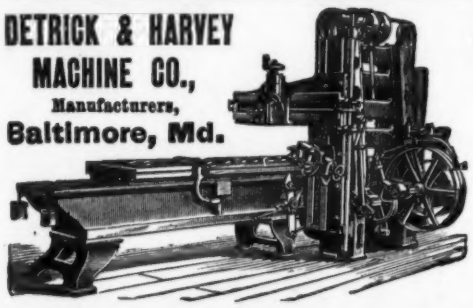

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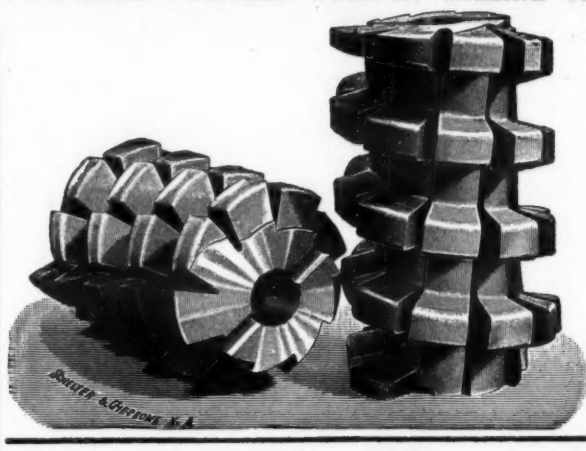

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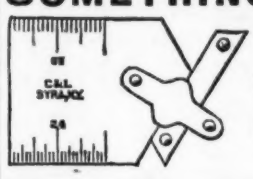

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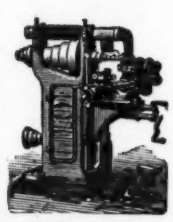

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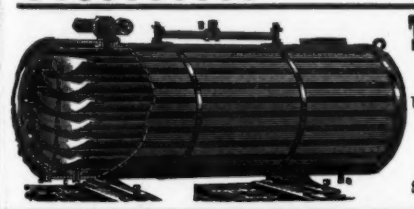

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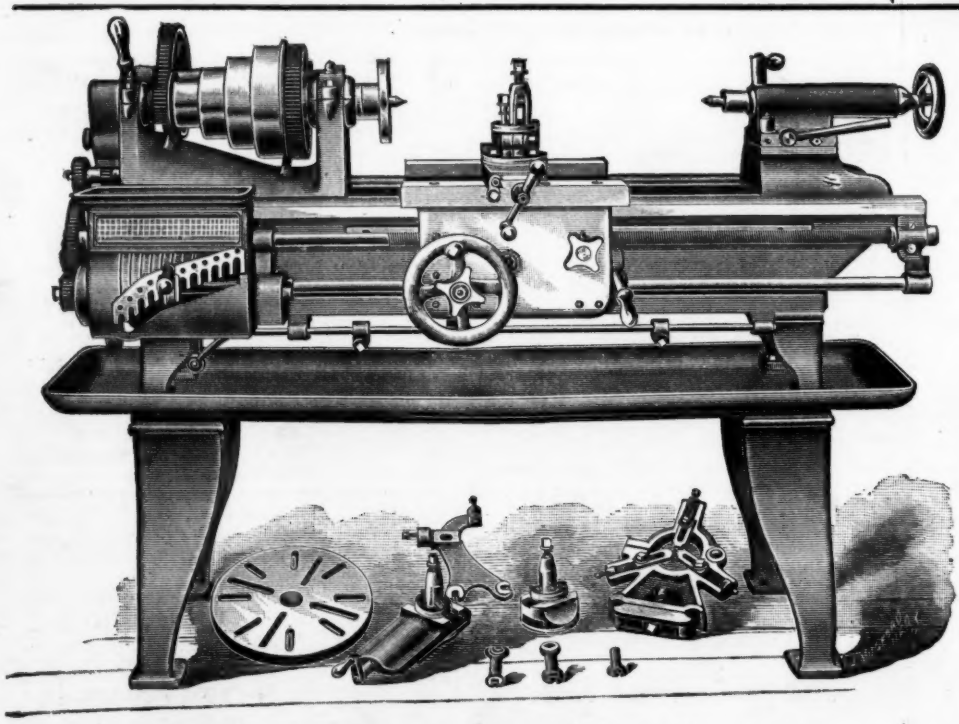

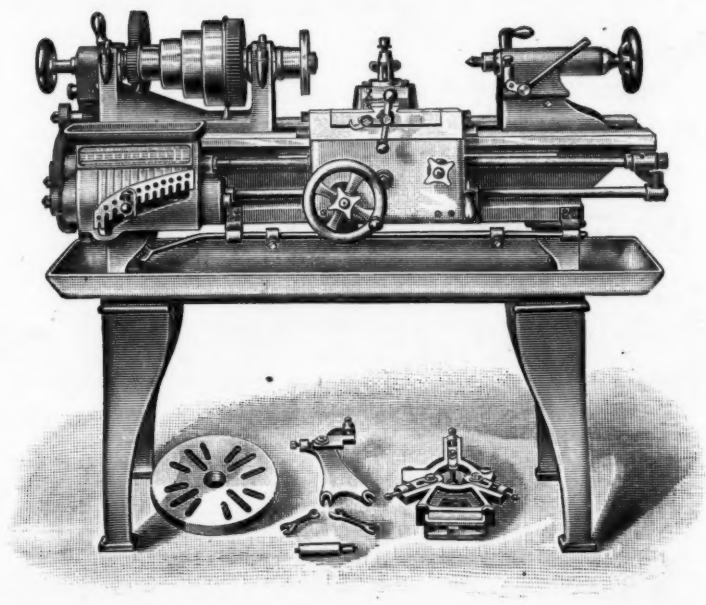

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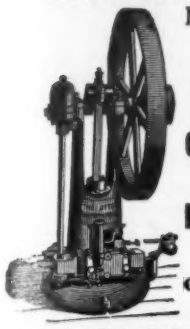

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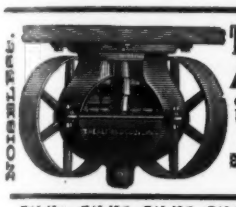

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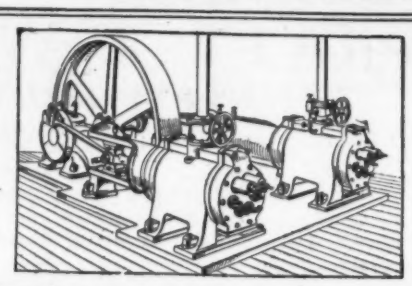

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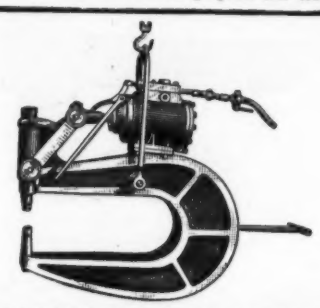

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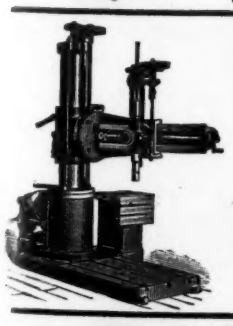

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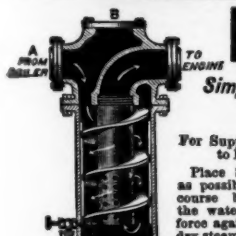

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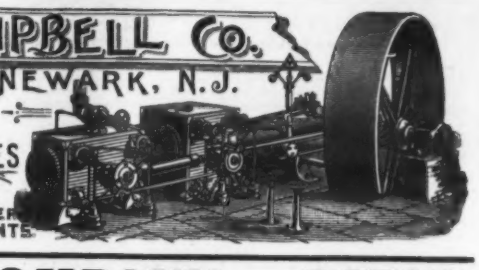

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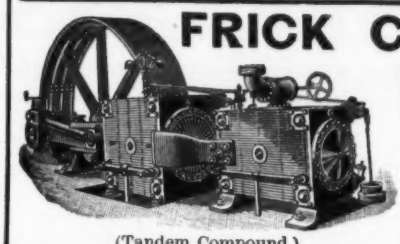

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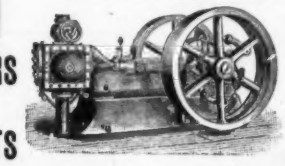

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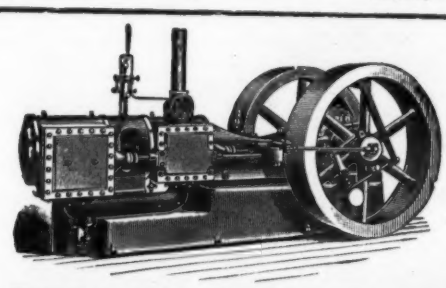

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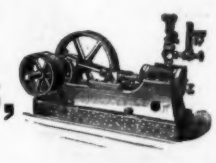

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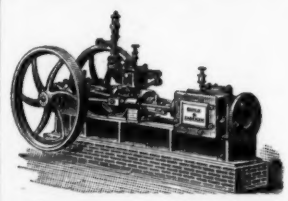

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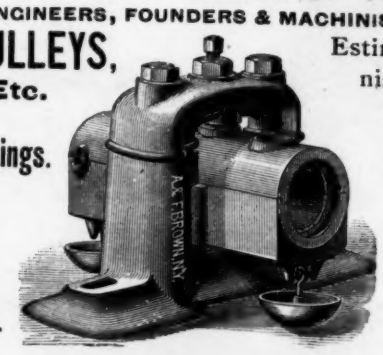

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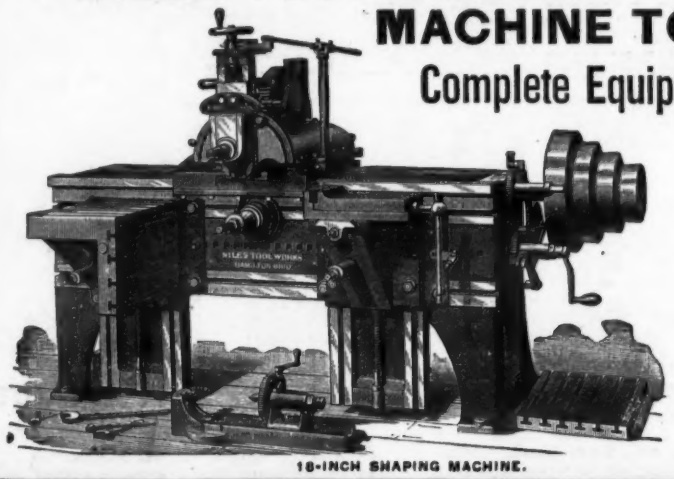

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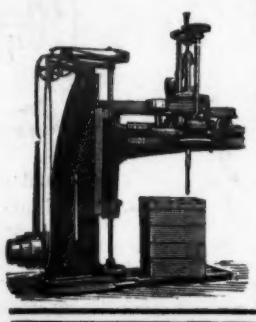

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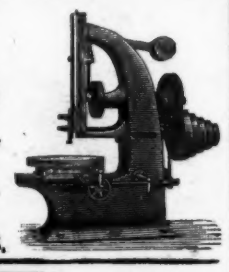

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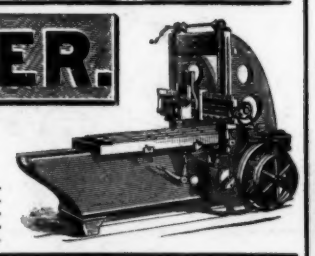

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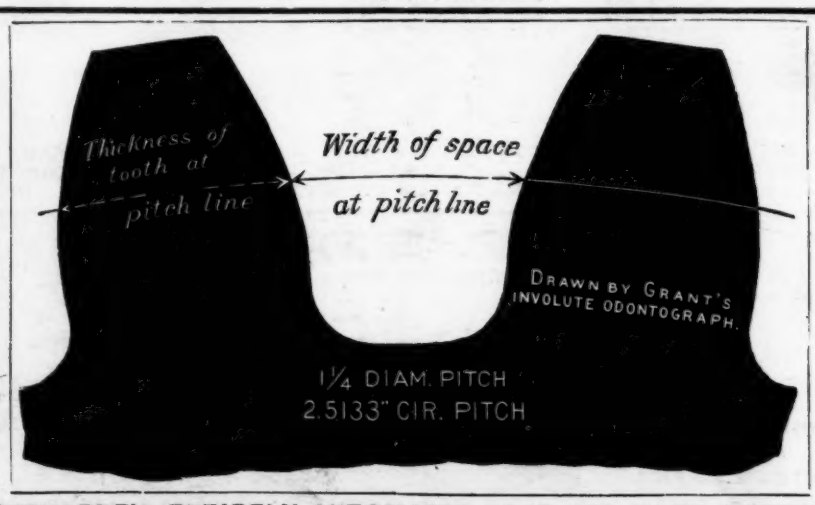
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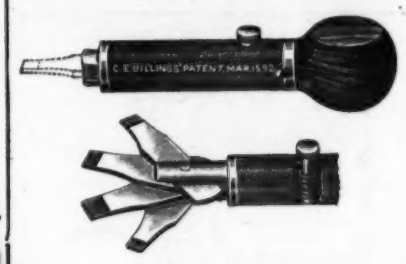

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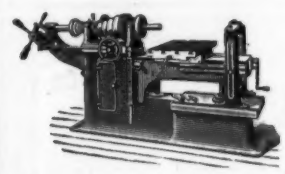

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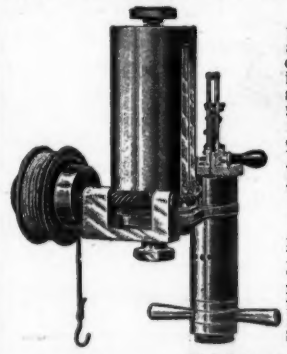

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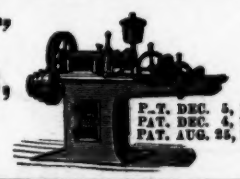

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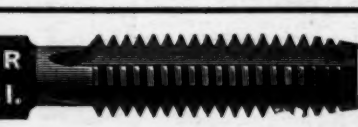

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